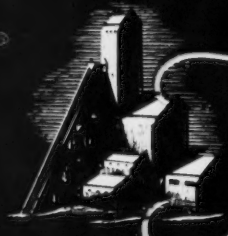
ENGINEERING AND MINING JOURNAL

JULY 1953

A McGRAW HILL PUBLICATION



Mining's greatest era

A panorama of expansion and technical development without parallel in the history of mining, a field where growth must be taken for granted in the drive to meet the world's unending need for minerals

★

180° F mixture against 152-ft head

Slag and water discharging into fill area at a major Swedish copper smelter near the Arctic Circle. Two Hydroseals in series pump the 180°F mixture against a total head of 152 feet, delivering about 400 tons of granulated slag per day at a rate of 2000 G.P.M.

You'll benefit by the pumping experience of HYDROSEAL ENGINEERS

Hundreds of money-saving installations in all corners of the mining world have made Hydroseal engineers outstanding authorities on all phases of abrasives pumping. Take advantage of their specialized knowledge the next time you have a tough problem to solve. You'll find that they're good men to know.

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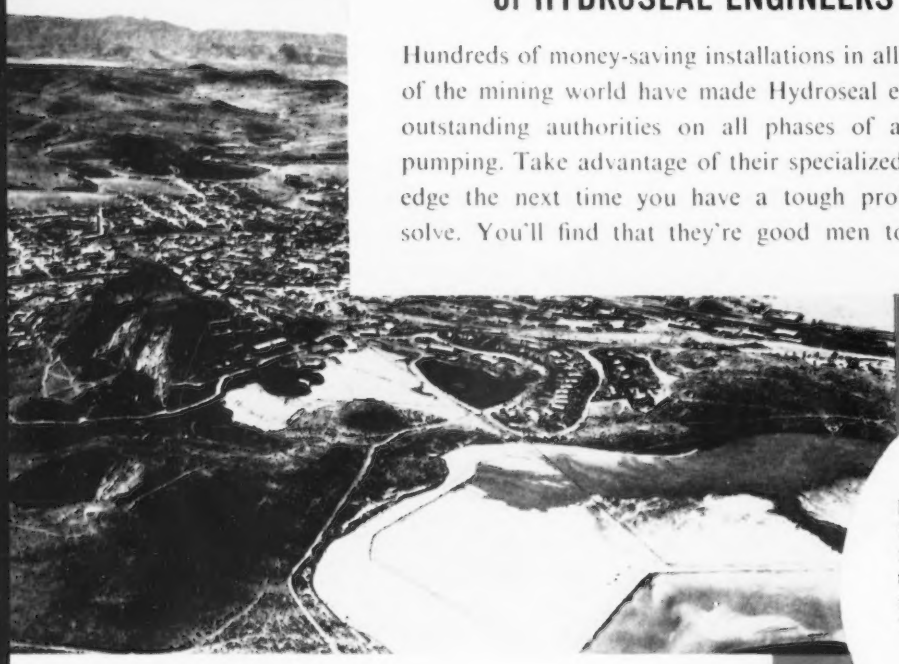
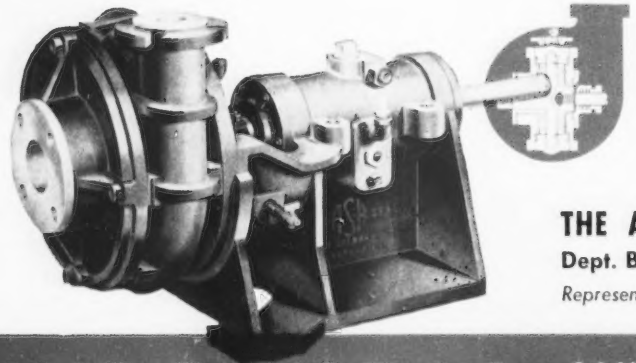


Through 3700 ft of 8-in pipe

Large zinc concentration plant in Mexico, showing tailings dam in right foreground. Tailings are delivered by two Hydroseal Slurry Pumps (one acting as standby) at an average rate of 760 to 1025 G.P.M. through 3700 feet of 8 inch pipe. Both pumps are equipped with automatic speed controls to compensate for changes in volume and/or head.



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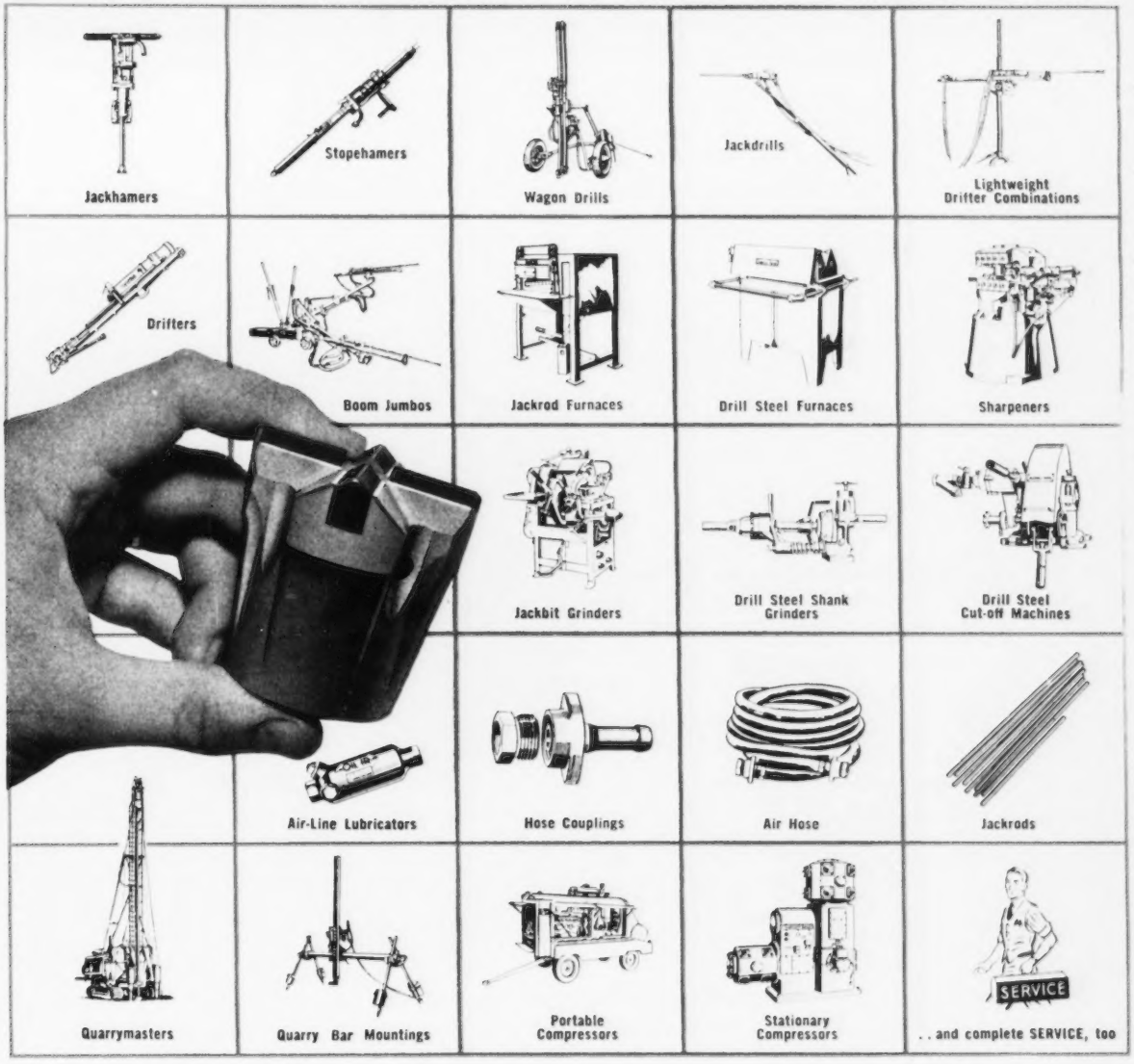
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

HYDROSEAL, PACKLESS AND MAXIMIX DESIGNS ARE COVERED BY PATENTS AND APPLICATIONS IN THE MAJOR MINING CENTERS OF THE WORLD



Behind the Carset Jackbit

A COMPLETE LINE OF ROCK DRILLING MACHINERY

Ingersoll-Rand supplies *everything you need* for drilling rock. That's why you can depend on I-R for a completely coordinated line of equipment that's designed to let you take full advantage of the tremendous savings made possible by longer-lasting, faster-drilling Ingersoll-Rand Carset Jackbits.

What's more, this complete I-R line is backed by 80 years of specialized experience in designing, building, applying and servicing rock drill equipment — for mining, tunneling, quarrying and construction work of all kinds.

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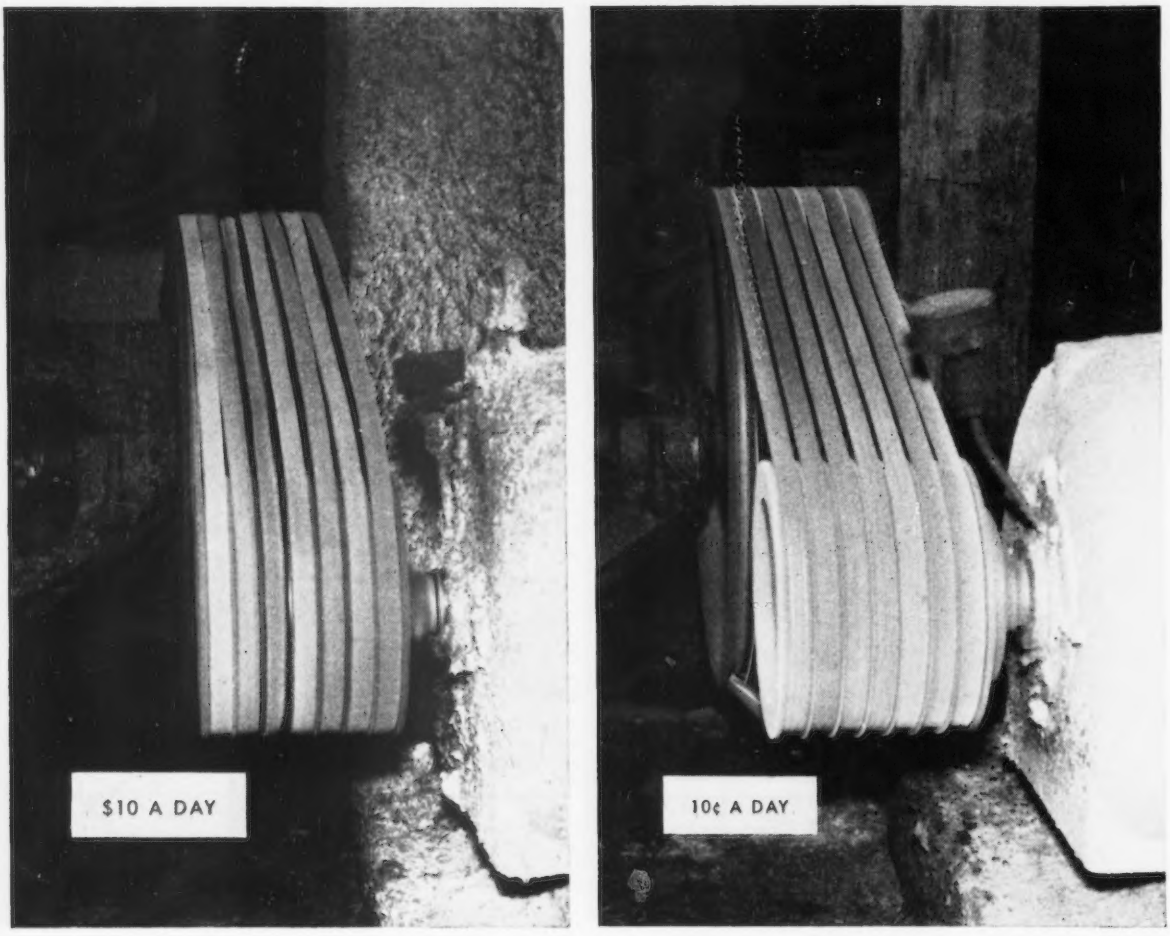
ROCK DRILLS • COMPRESSORS • AIR TOOLS • CENTRIFUGAL PUMPS • TURBO BLOWERS • CONDENSERS • DIESEL AND GAS ENGINES

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER



How these B. F. Goodrich belts cut costs from $10 a day to 10¢

A typical example of B. F. Goodrich improvement in rubber

THOSE pictures are of identical drives in the same plant. At left are ordinary V belts. Tension made them stretch out of shape so fast that $75 of belts only lasted 7 days—over $10 a day.

Then B. F. Goodrich grommet belts were tried. They lasted not 7 days but more than two years! B. F. Goodrich had tumbled belt costs from $10 a day to 10¢!

A grommet is a cord loop inside the belt. It is made like a giant twisted cable except that it's endless—no splices or overlaps. Grommet belts are more flexible, don't slip or stretch as much as ordinary belts. No other kind of belt has grommets; no other belt stands so much punishment or lasts so long.

Outlasting other rubber by many times is nothing unusual for products improved by B. F. Goodrich research. The cord conveyor belt which can last 10 times longer is typical of this. And the Burstproof steam hose that protects workers from scalding and injury makes a saving in safety as well as money. To find out more about these money-saving improvements and what they can do for you, send the coupon now for free facts on those rubber products you use.

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Dept. M-54, Akron 18, Ohio
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☐ Burstproof steam hose
☐ Other rubber products (name types) _____
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☐ Have a BFG distributor see me.
Name _____
Company _____
Address _____

Grommet V-Belts BY
B.F.Goodrich

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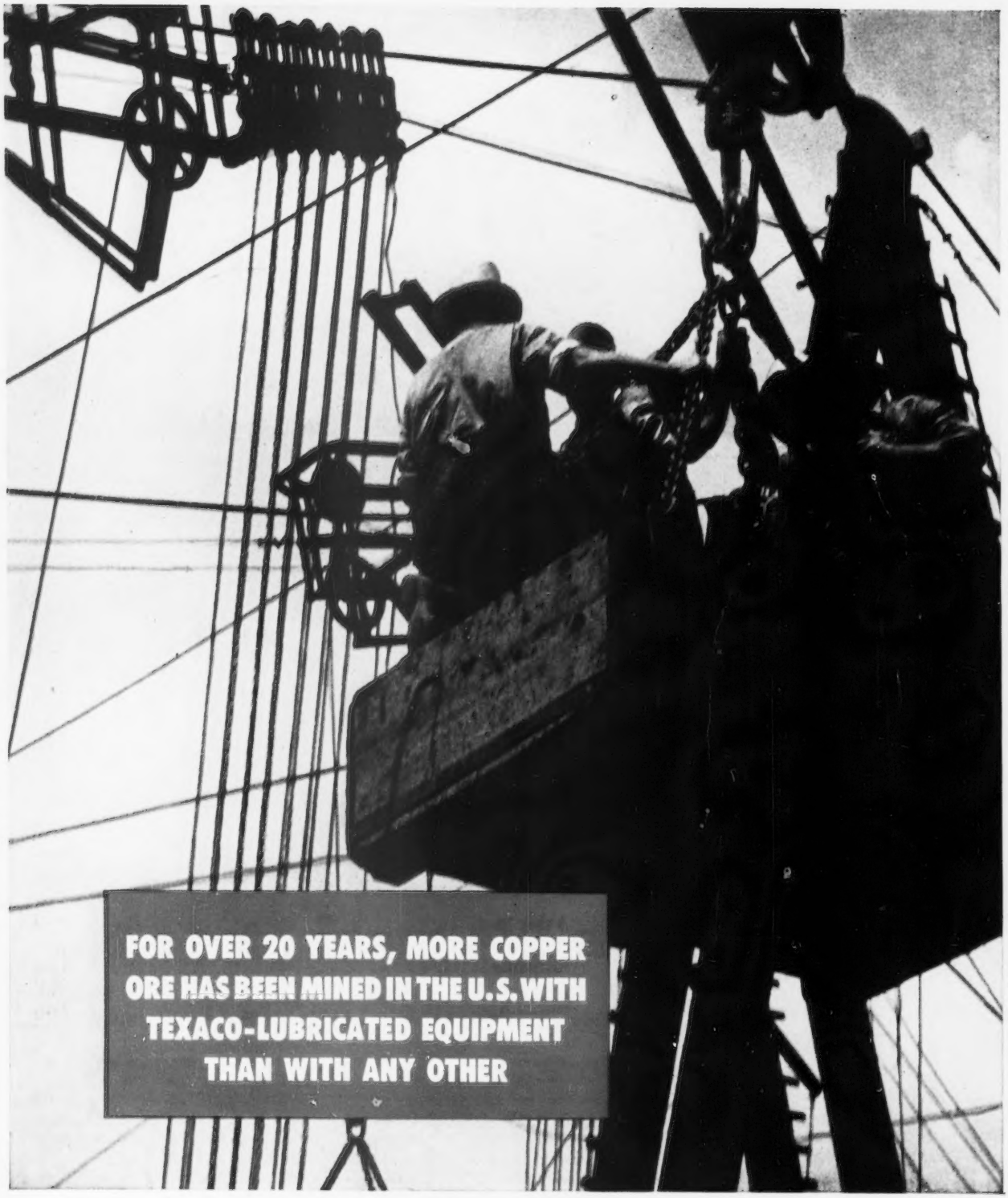

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In all types of mine car wheels, use *Texaco Olympian Grease.* You'll get easier starts winter and summer, assure smoother operation, reduce maintenance costs.

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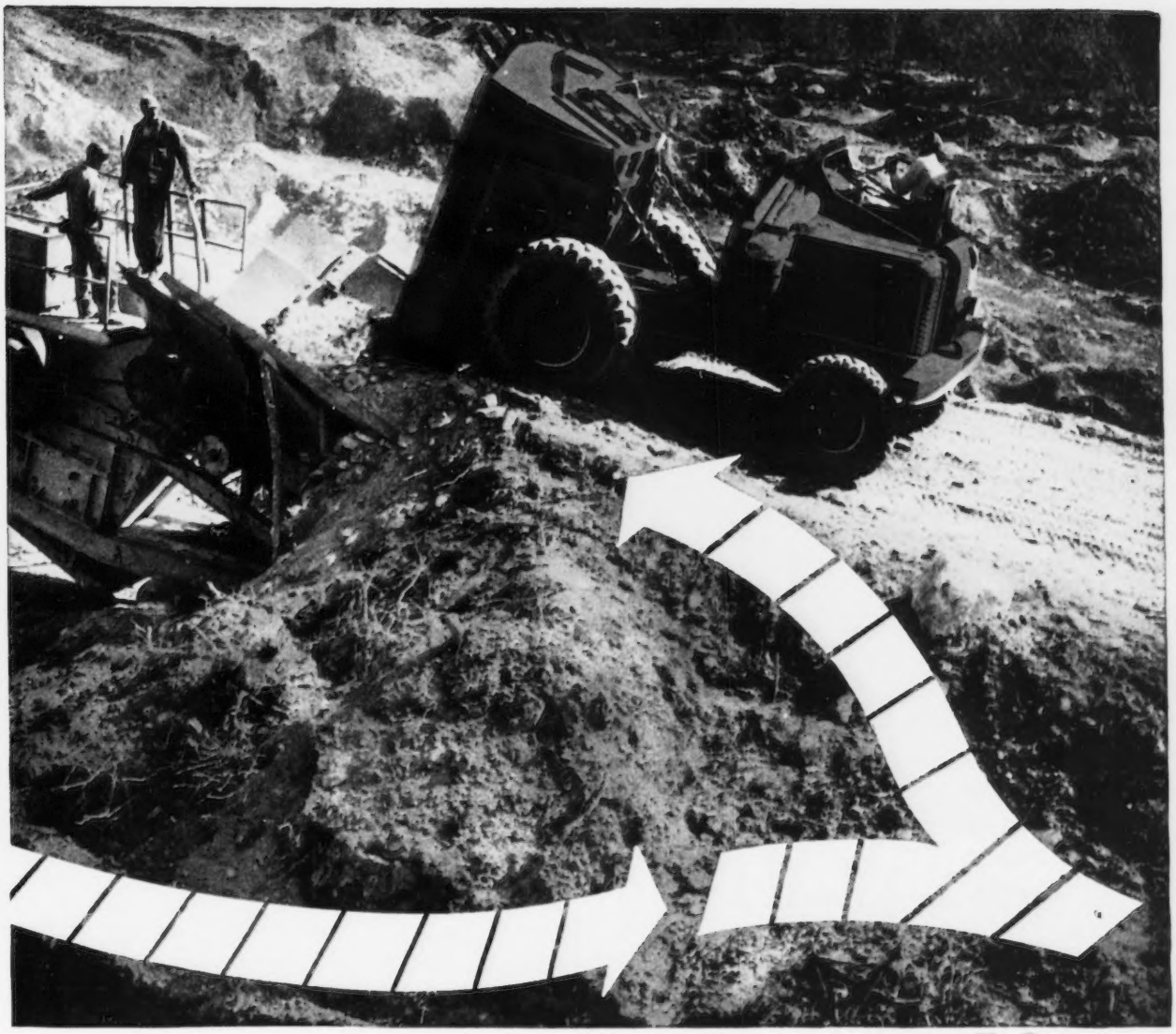
Lubricants and Fuels
FOR THE MINING INDUSTRY

NO-TURN SHUTTLE HAUL

In confined underground operation, fast-shuttling Dumpters are ideal for no-turn hauling in tunnels and along narrow passageways. Also note how low rear entry to Dumpter body permits easy loading under low ceiling. Compact body is 8' x 8' for loading over end or sides.

This mountain-side job shows typical no-turn shuttle advantage. Hauling along narrow ledge, Dumpter spots close to Koehring 1½-yard 605 — gets its load, drives to fill, dumps, and returns to the shovel — without turning. Dumpters are operated with equal ease in both directions.



increases hourly output over 10%

With Koehring fast-shuttling Dumptors, there is no need to turn at the loading unit, along narrow haul roads, or at the dump. Koehring constant-mesh transmission gives the same 3 fast speeds forward and reverse. Every turn saved cuts 15 seconds off your cycle time, and adds up to a big increase in yards hauled per hour.

On a 1,000-foot haul, eliminating only 2 turns saves ½ minute every round trip. Where you would get an average of 13.6 trips per hour with 2-turn operation, Dumptor *no-turn shuttle hauling* gives you 15.4 trips. That's an increase of 1.8 trips an hour on the same, 1,000-foot haul.

Fast, easy spotting and 1-second gravity dump also help keep production high. Your Koehring distributor can show you many other cost-cutting advantages with heavy-duty, 6-yard Dumptors.

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This wealth of experience, and this complete line of proven equipment, are at your service. Whatever the problem, your Ingersoll-Rand representative may be able to help you find the one *best solution*—be it equipment, application engineering or field service.

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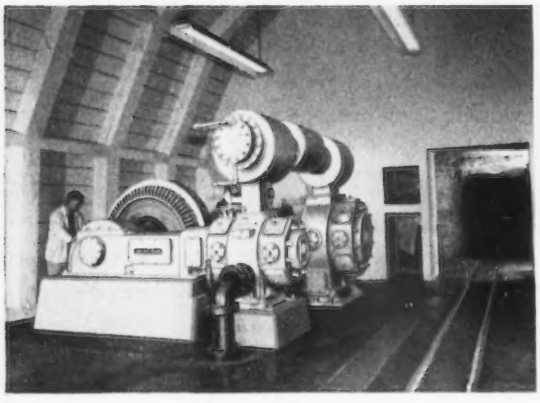
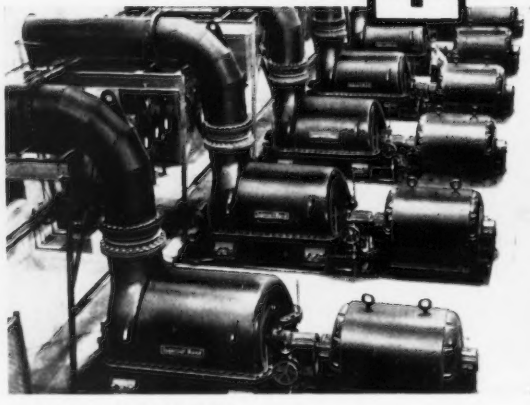


AIR COMPRESSORS

I-R stationary and portable compressors are preferred the world over as a source for dependable, low cost air power in mining service. The 400 hp PRE unit shown above is located underground, 6000 ft from the portal.

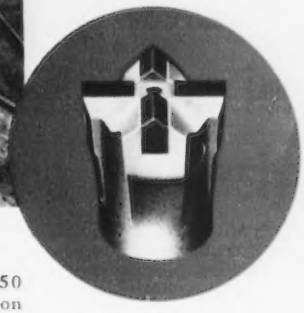


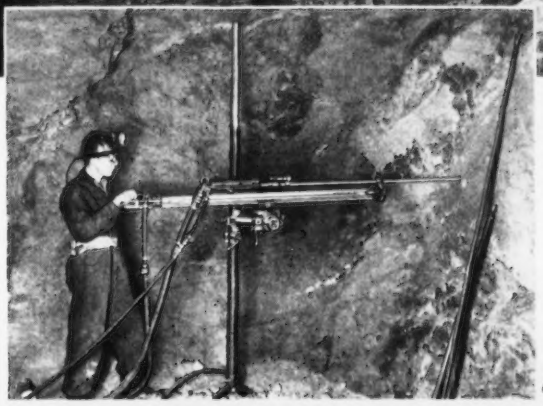
TURBO BLOWERS

I-R Turbo-Blowers have built an enviable performance record for long, trouble-free service in metal refining and smelting plants. The six units shown above, installed in a large copper converter plant, have a combined capacity of 157,000 cfm at 15 psi.

UNIVERSAL JACKDRILL

The JR-38 combines important new features never before available in an air-feed-leg unit. Can be used as a stoper —a drifter—or a Jackhamer. Gives new speed and convenience in setting up, collaring, drilling and hole blowing. Available with 2', 3' or 4' feed legs.



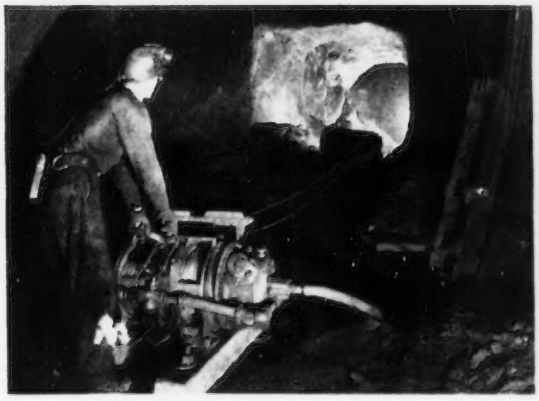


DRIFTERS

Light-weight D-50 Drifter Combination saves time and labor in small headings and flat-hole stoping. Includes powerful D-50 Drifter, fast PF-3 power feed, aluminum shell, aluminum alloy arm and clamps and pneumatic column.

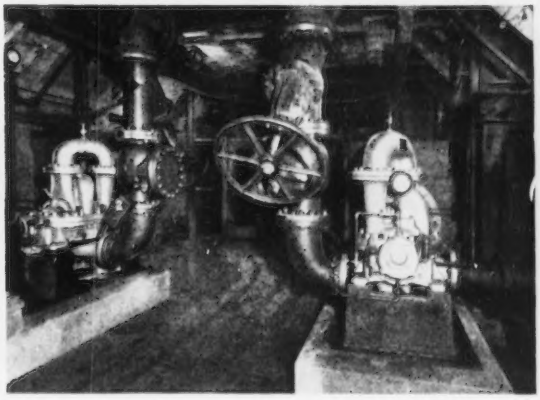
CARSET JACKBITS

Pioneered by Ingersoll-Rand the Carset Jackbit drills faster, has negligible gauge wear, practically eliminates bit changes, saves manhours all along the line.



SLUSHER HOISTS

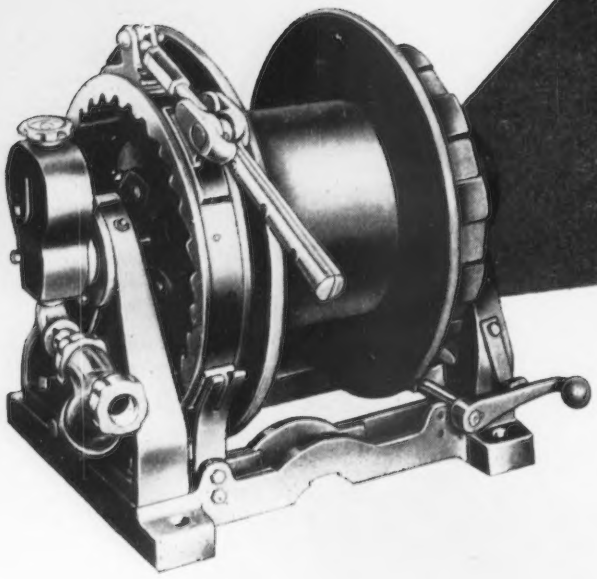
I-R's complete line of highly efficient, low maintenance air or electric driven slusher and scraper units covers every requirement for underground or surface mining. The two-drum, air-powered unit shown above is used for scraping muck into a vertical raise approximately 220 ft from the face.

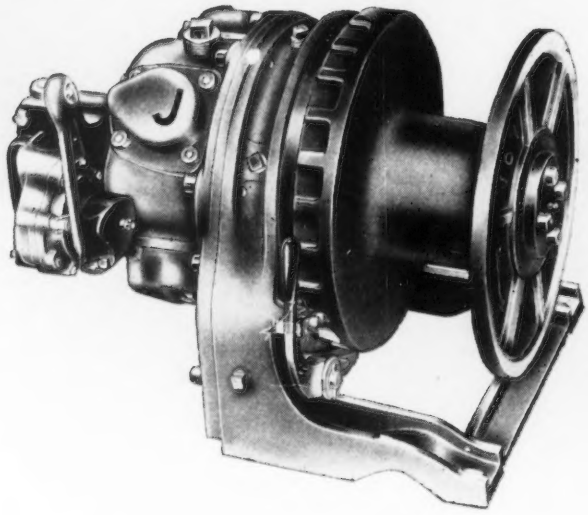


CENTRIFUGAL PUMPS

I-R centrifugal pumps have proved their outstanding economy and dependability under the most severe conditions of mine service. Each of the four-stage, 500 hp units shown handle 800 gpm at 1700 ft head in a centralized drainage system for a group of copper mines.

You'll get JOY





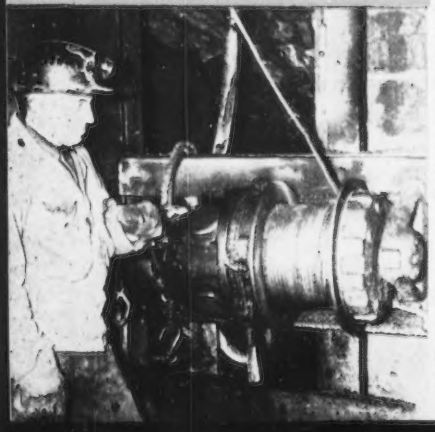
TOP: Model F-113 "Turbinair". Compact, simple design with motor *inside* the drum. Direct power transmission from motor to drum assures maximum efficiency. Simple, accessible controls make operation easy.

RIGHT: Model DW-111 "Pistonair". Features reversible power with light weight. Four-cylinder, 3½ h.p., reversible motor will handle up to 1200 lbs.

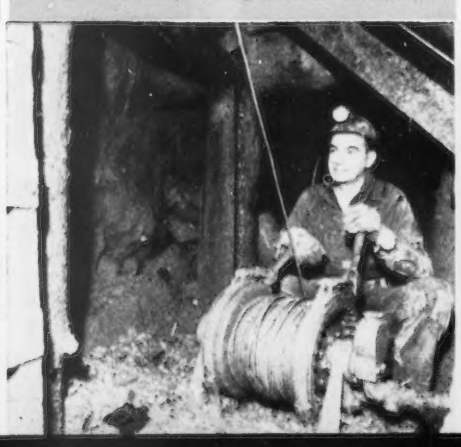
FAR RIGHT: Model L-111 "Pistonair". For heavy hoisting jobs. 7½ h.p., reversible, five-cylinder motor for loads up to 2000 lbs.

OVER 100 YEARS OF ENGINEERING LEADERSHIP

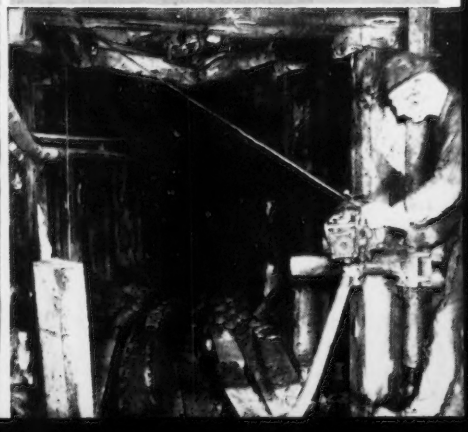
Joy L-111 reversible "Pistonair" Single Drum Hoist operating in a magnetite iron mine in the Adirondack region of New York.



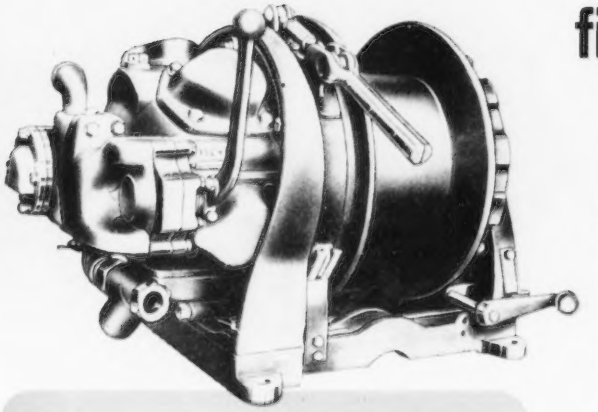
Joy E-112 "Turbinair" lifting timbers in a raise in a western mine. The extra rope capacity of the E-112 (450' of ⅜" rope) makes it applicable to *any* of the utility hoisting needs in this mine.



Joy AW-80 Air Winch hoisting timbers into place in a drift in a Canadian mine. At a weight of only 85 lbs., this unit will lift *500 lbs!*



BETTER SERVICE from SINGLE DRUM HOISTS



They're real Mining Hoists—designed and built from long field experience expressly for underground use

Joy Single Drum Mining Hoists are compactly designed, of modern, high-strength alloy metals, for lighter weight with greater power and efficiency.

The complete Joy line includes the "Turbinair" series which develop maximum horsepower per unit of weight; the "Pistonair" with reversible four or five cylinder motors; and compact, rugged electric-powered models which feature space-saving short-length external motors.

Joy Single Drum Hoists are built with lifting capacities ranging from 500 to 3500 lbs., and rope capacities from 150 to 1500 ft. "Pistonair" models have a positive acting safety brake which holds the load in any position when the throttle valve is "off."

Joy also manufactures a complete line of Shaft Hoists, and Two- and Three-Drum Slusher Hoists in capacities to handle all hoisting and scraping needs.

Write for Bulletin, or . . .

Consult a Joy Engineer

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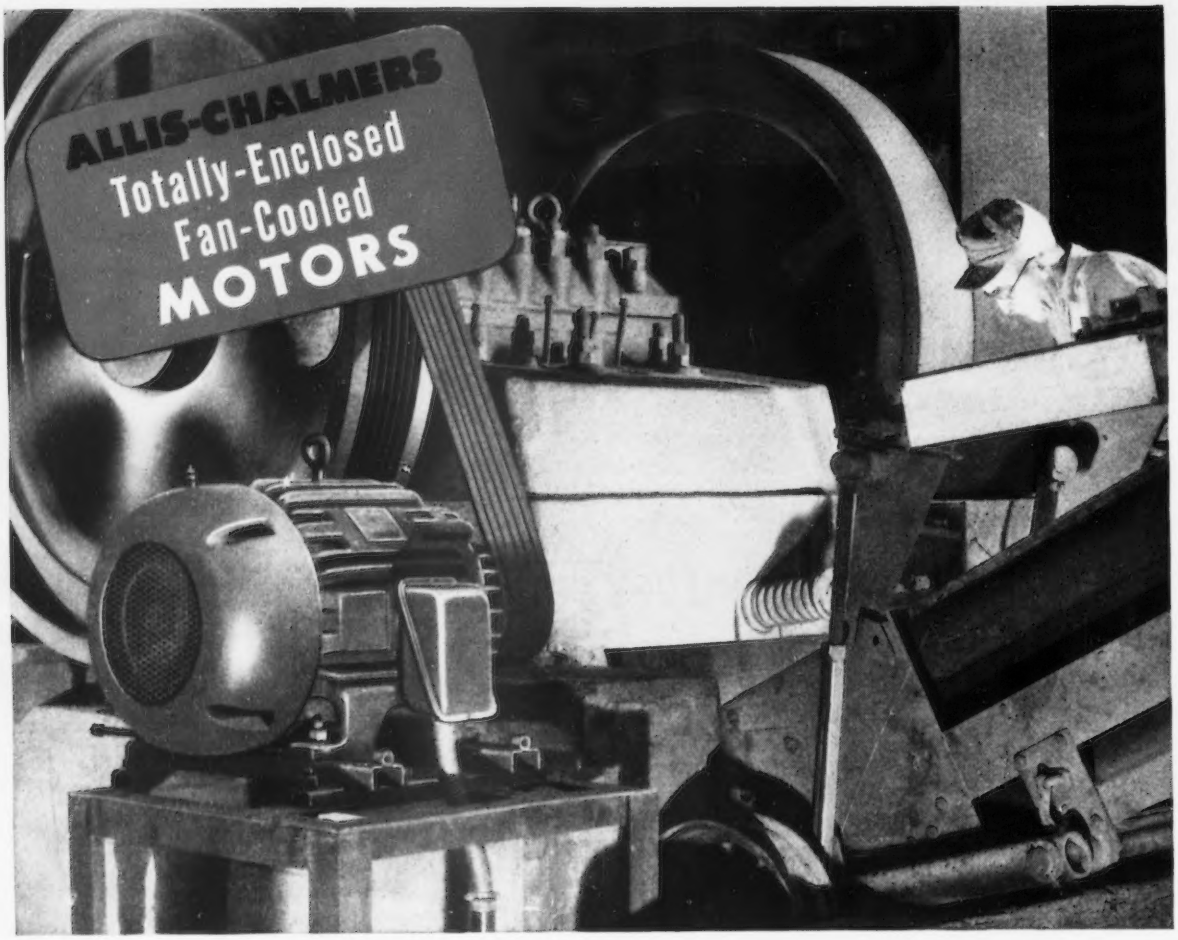

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No enclosed external air passages to clog. Easy to clean with cloth, brush, air hose or vacuum. Simply remove fan cover and whole radiating surface is exposed for inspection and cleaning.

2 Cast Iron Construction

Frame, conduit box and fan cover of cast iron resist corrosion. Fan is non-sparking, corrosion-resistant material. Well suited to outdoor operation.

Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

3 Pre-lubricated Bearings

Ball bearings are double-shielded type, pre-lubricated at the factory. Periodic lubrication is not required under normal operating conditions, but provision is made for in-service lubrication if necessary.

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TEXROPE V-belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

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Peter Kiewit has owned many Northwests and he has used them in practically every class of digging in both mining work and general contracting. He has proved them to be *real* Hard Rock Shovels.

In many cases, Northwest speed has out-produced slower machines of larger capacity. The Northwest Dual Independent Crowd, which utilizes force most other Independent Crowd Shovels waste, gives a smooth cut through the bank. No stutter, no recuts, no dipper juggling!

Northwest Uniform Pressure Swing Clutches eliminate the jerks and grabs that delay spotting and Northwest Crawlers and steering, speed up relocation on mine floors and benches. Add to this the Northwest dependability that keeps the upkeep down, a feature that is mighty important in far away locations. These are among the advantages that have put so many Northwests in mining and quarry work. They are just a few of the many reasons why Peter Kiewit has found Northwests so successful.

NORTHWEST ENGINEERING COMPANY
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Has Your Shovel Stood the ROCK TEST

NEW TRENDS IN MINING MECHANIZATION

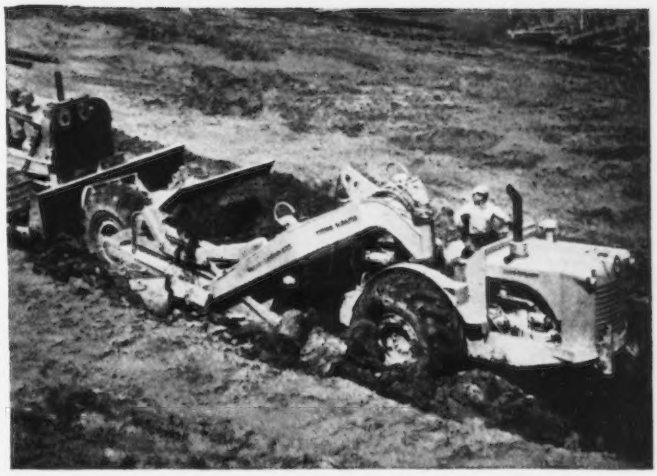
Stockpiles processed ore. HD-20 Tractor also builds access roads . . . maintains tailings dumps . . . cleans up around shovels . . . cuts drainage ditches . . . digs sludge basins and sluice-ways . . . builds reservoirs and pond dams . . . clears and levels building sites . . . tows equipment.

Loads ore underground. HD-5G Tractor Shovel also loads sand and gravel, other bulk materials . . . cleans up around conveyors and hoppers. Special materials buckets, bulldozer blades, other attachments available. Tractor shovels available for all sizes of Allis-Chalmers crawler tractors.

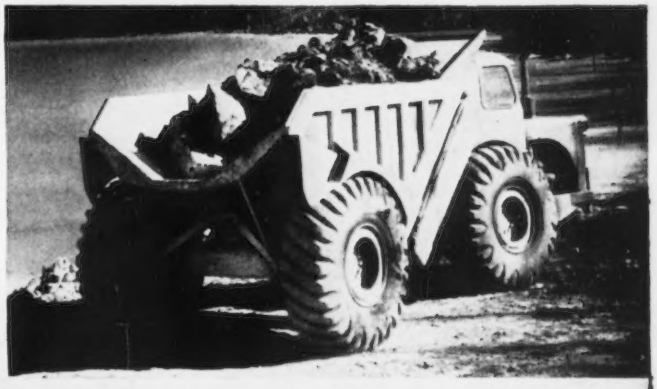
Builds and maintains haul roads. AD-40 Motor Grader levels pit bottoms . . . digs and grades for drainage . . . scarifies . . . prepares dragline sites. Gasoline-powered Model D Grader also available. Handles routine road maintenance — light construction, etc.

TODAY'S demands on mining production require the selection of equipment of the broadest versatility. Allis-Chalmers offers a complete range of material moving and handling equipment — including four sizes of diesel crawler tractors, motor graders, pull scrapers, high-speed Motor Scrapers and Motor Wagons — designed to fit your particular mining applications and to deliver the highest possible output.

Here are some on-the-job views with a few of the many ways in which these modern machines are speeding production and lowering costs.



Strips overburden. 13-yard heaped capacity TS-200 Motor Scraper also loads, hauls material from open pit . . . clears and levels for camp sites and drill setups . . . levels and grades building sites . . . hauls in supplies. Larger 18-yard heaped capacity TS-300 also available.



Hauls rock overburden. TR-200 Motor Wagon hauls tailings, sand, gravel, silicon, lead and zinc ore. Unit travels fast "off-road" with capacity loads . . . dumps clean every time with 18-ton, hydraulic-controlled rear-dump body. Sides channel-ribbed for rigidity.

Levels tailings dump. HD-20 Tractor with pull-type scraper also loads and hauls ore-bearing material — handles large-scale stripping jobs. Exclusive Allis-Chalmers hydraulic torque converter on HD-20 gives higher output, less upkeep on pulling, pushing and dozing work.

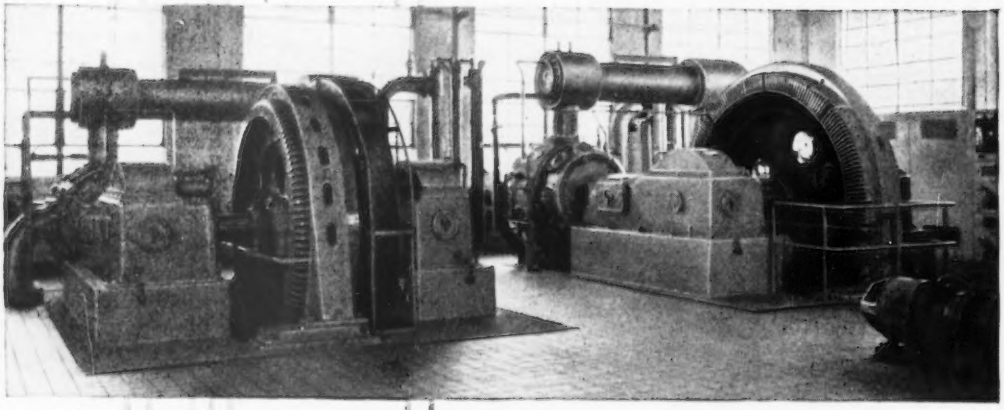
Complete line of pull-type scrapers available, from 2-yard to 18-yard sizes.

Your Allis-Chalmers dealer will be glad to analyze your equipment needs and help you select the right machines for your jobs. See or phone him soon to watch these machines in action.

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

NO CLOCK PUNCHING

for these compressors



That's right! There's no daily time limit placed on the work output of Chicago Pneumatic Class O-CE Compressors . . . they operate "around the clock" with a minimum of attention. Designed for continuous, year-in, year-out heavy industrial usage, these units are unsurpassed for a dependable air power supply at low cost. Built in sizes up to 2,000 hp, for pressures up to 5,000 lbs., they are available in horizontal, two-stage, water-cooled types with direct-mounted synchronous motor drive.

The Chicago Pneumatic Class O-CE Compressor is equipped with roller bearings, Simplate valves for low power consumption, streamlined air passages to cut down air flow resistance, CP Multi-Step Control for partial load economy, and a CP Intercooler for maximum heat transfer and low water consumption. Ask for Bulletin 726. *Chicago Pneumatic Tool Company, 8 East 44th Street, N. Y. 17, N. Y.*

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

If you STALL—profits STOP!

WHEN a tire fails to *grip* and take you through, you lose time and money. When a tire "dies" on the job, men and equipment stand idle, profits disappear.

That's why the *only* tires you can afford are the best *workers*—the ones that can take on tire-killing jobs, day in, day out—and keep going!

Only worlds of experience can build such tires—*and Goodyear has it*—for Goodyear has built more tires for more uses than anyone else on earth!

This enormous, unequaled experience gives Goodyear a *practical* approach to your tire problems that means better pull and longer wear. So why not protect *your* profits with the tires that have *proved* they pay their own way, day after day, on the toughest jobs on earth?

Goodyear, Truck Tire Department, Akron 16, Ohio

FOR EACH JOB, THERE'S A COST-CUTTING GOODYEAR TIRE!

You can't beat the
HARD ROCK LUG
for stamina and bruise resistance on jobs where rocks and snags ruin other tires.

You can't beat the
HARD ROCK RIB
for front wheels on all tire-killing service. Rugged—smooth rolling—easy steering.

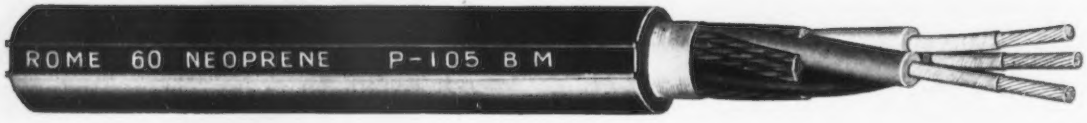
You can't beat the
ROAD LUG
for toughness and super-traction OFF the road and long, smooth mileage ON the road.

Road Lug - T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

GOODYEAR

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

Use Rome 60 Mining Cables



It Costs Less to Buy the Best!

for *all* your mechanized equipment

For

SHUTTLE CARS

Rome 60 Flat Twin (Parallel Duplex) Mining Machine Cable—600 volts

Type G (grounded) · Type W (ungrounded)

Here is the popular shuttle car cable. Flat construction permits compact reeling. Neoprene web between conductors protects against mechanical shock, short circuits.

LOADERS, SHOVELS and other mobile equipment

Rome 60 Portable Power Cables —two, three and four conductors

Type G (grounded) up to 5000 volts
Type W (ungrounded) up to 3000 volts

This heavy-duty, multiconductor portable power cable is particularly recommended for use of electric shovels, loaders, mucking machines and other equipment where delivery of a heavy power load is required. Conductors are assembled with rubber-like fillers to protect against rotting and mechanical injury—assure maximum flexibility.

DRILLS AND PORTABLE TOOLS

Rome 60 Heavy Duty Cords

Type SO

Designed for heavy duty use, Rome 60 portable cords are manufactured with extreme flexibility for ease of handling, combined with the ruggedness of pressure molded Neoprene sheath. They represent premium quality and are particularly suitable for any application involving the use of portable tools.

Rome 60 mining cables are designed for the roughest, toughest jobs. They're made for a long life of gruelling service on mechanized equipment.

A sturdy, open-braid reinforcing permanently interlocks or "gears" the conductors to the protective sheath. No possibility of loosening or sheath separation here, yet utmost flexibility is assured.

The sheath itself is all-resistant Neoprene, molded in lead to a tire-like toughness. It is resistant to moisture, flames, acids, oils, abrasions. A specially compounded heat-resistant rubber insulation, suitable for operation at 75° C., provides maximum overload protection.

Investigate *Rome 60* mining cables and you'll see why so many mines standardize on them.

Rome manufactures a complete line of cords and cables for mine use. "P-105 BM" molded in the Neoprene sheath is your assurance of compliance with Federal and State of Pennsylvania safety codes. In addition to the cables shown, the *Rome 60* line includes:

- TYPE SO PORTABLE CORDS
- SHOT FIRING CORD
- MINE POWER DISTRIBUTION CABLE
- SHOVEL AND DREDGE CABLE

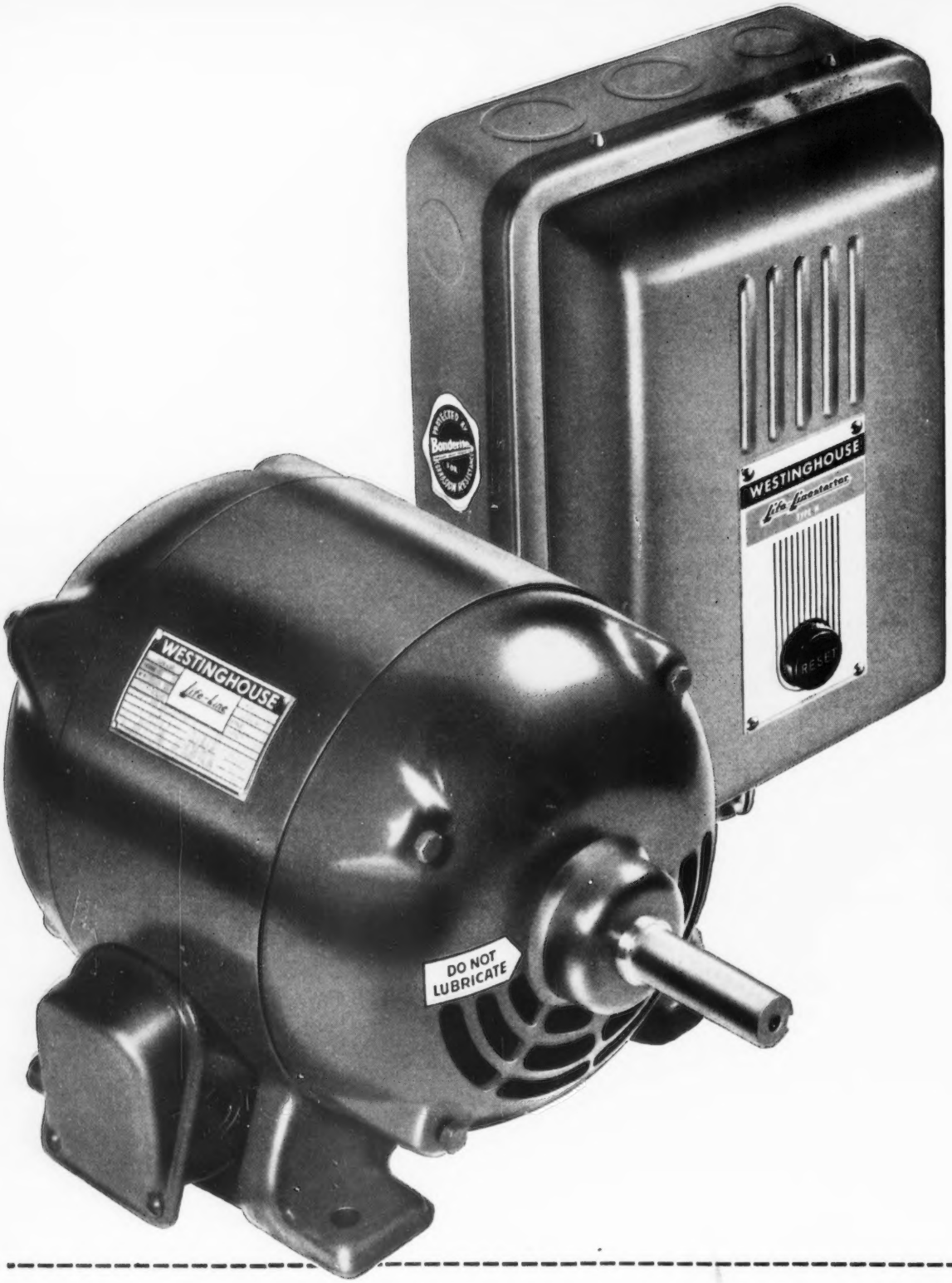
For Maintenance, Shops and Buildings

Rome also offers a wide selection of power and control cables, building wires—both rubber and thermoplastic insulated, as well as portable cords for small tool use. All are manufactured to Rome's high-quality standards—your assurance of long, dependable service.

ROME CABLE Corporation
ROME · NEW YORK
and
TORRANCE · CALIFORNIA

ROME CABLE CORP., Dept. MJ-7, Rome, N. Y.
Please send me the Rome 60 Mining Cable Folder.

Name .....
Company .....
Address .....
City ..... State .....



WHAT *Life-Line* REALLY DELIVERS IS MORE SERVICE...LESS SERVICING

See how the maintenance has been engineered out with modern *Life-Lines*

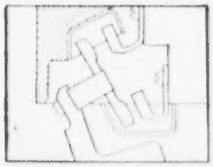
Forget your previous ideas of motor and control maintenance. The advanced design of Life-Line motors and Life-Linestarters sets new lows in maintenance. Excessive maintenance has been engineered out—in advance.

Take the Life-Linestarter for example: There are fewer moving parts. Operation is simple. No complex linkage in contact closing arrangement. No sliding surfaces. No hinge pins. Contacts, too, are protected by the exclusive deionizing principle of arc extinction—the most efficient method devised. Contact burning is minimized—contact maintenance engineered out!

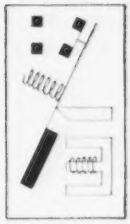
And the Life-Line motor has set new standards for motor manufacturers. Pre-lubricated bearings do away with lubrication maintenance. Heavy structural steel gives new strength . . . provides more torque per pound. New stator slots and insulating material add years of maintenance-free service.

Summed up—what is really engineered and built into Life-Lines is simply—more service on the job—less servicing, and down time. Ask your Westinghouse representative to show you proof that Life-Line motors and Life-Linestarters are the equipment built to match the high productivity requirements of today's industry. A call to your local office will bring you fast service, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21696-A

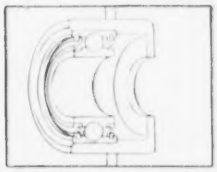
YOU CAN BE SURE... IF IT'S Westinghouse



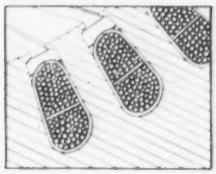
STARTER *Exclusive "De-ion"" Arc Quencher* confines, divides, extinguishes hot arcs fast!



Never Jams. No sliding surfaces to wear—no sticking—no jamming—nothing to wear or replace.



MOTOR *Needs No Lubrication.* Pre-lubricated factory-sealed bearings eliminate troubles due to over or under lubrication, dust and dirt.

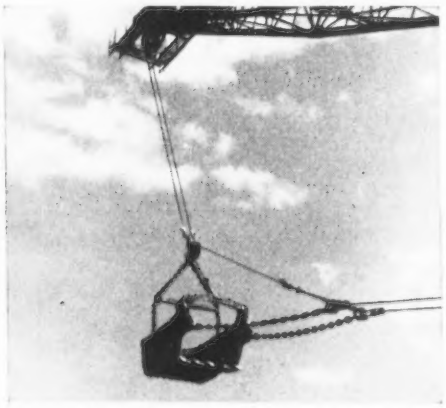


Cuts Winding Burnouts. Pear-shaped slot design eliminates pockets. No corner voids remain to collect dirt, moisture.

The Bigger Digger moves

THE BIGGER DIGGER makes a round trip once a minute . . . moves 21.5 cu. yds. each trip. Huge loads like that put a terrific stress on boom suspension cables, but Tiger Brand Boom Support Strand has the needed strength.

THE DRAG LINES on the Bigger Digger must withstand a lot of wear and heavy pulls. Special Tiger Brand Drag Lines meet these requirements and give long service.



THE HOISTING ROPES are Tiger Brand too. They have the fatigue resistance needed for constant flexing over sheaves and drums.

Send for helpful guide book

American Steel & Wire
Room C-73, Rockefeller Building
Cleveland 13, Ohio

Please send me, without obligation, a copy of your "Wire Rope Recommendation Book."

Name.....

Company.....

Address.....

City & State.....

1,000,000 cu. yds. a month

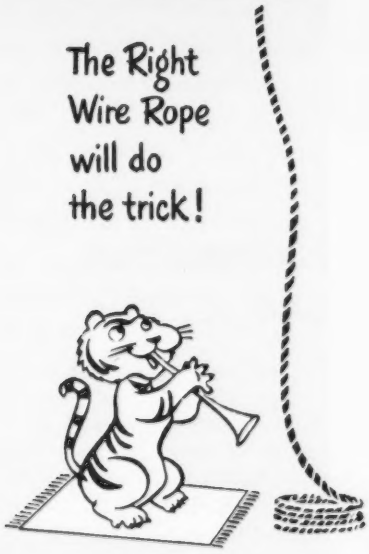
-with Tiger Brand Wire Ropes

● This huge dragline scoops out overburden and phosphate matrix at the rate of 21.5 cu. yds. per minute. It's the Bigger Digger at International Minerals & Chemical Co.'s phosphate mine near Mulberry, Florida. Drag lines, hoist ropes, and boom suspension cables on the Bigger Digger take a lot of hard wear—and they have to be strong. Amercian Tiger Brand Wire Ropes provide the right combination of strength, wear resistance, and flexibility for these tough jobs.

The duty on the boom suspension cables is especially exacting. The Bigger Digger has the longest boom on record—215 ft. long—and the suspension cables, besides great tensile strength, must possess strictly uniform physical properties. Tiger Brand Boom Support Strand just fits these tough requirements.

You can choose from these and hundreds of other types and sizes of Tiger Brand Ropes—there's one that has been specially designed to suit every wire rope job you have. Our "Wire Rope Recommendation Book" is an excellent guide to the proper selection of ropes. It's packed with helpful application information and lists the best ropes to use for typical rope jobs. Just send the coupon for a free copy.

The Right Wire Rope will do the trick!



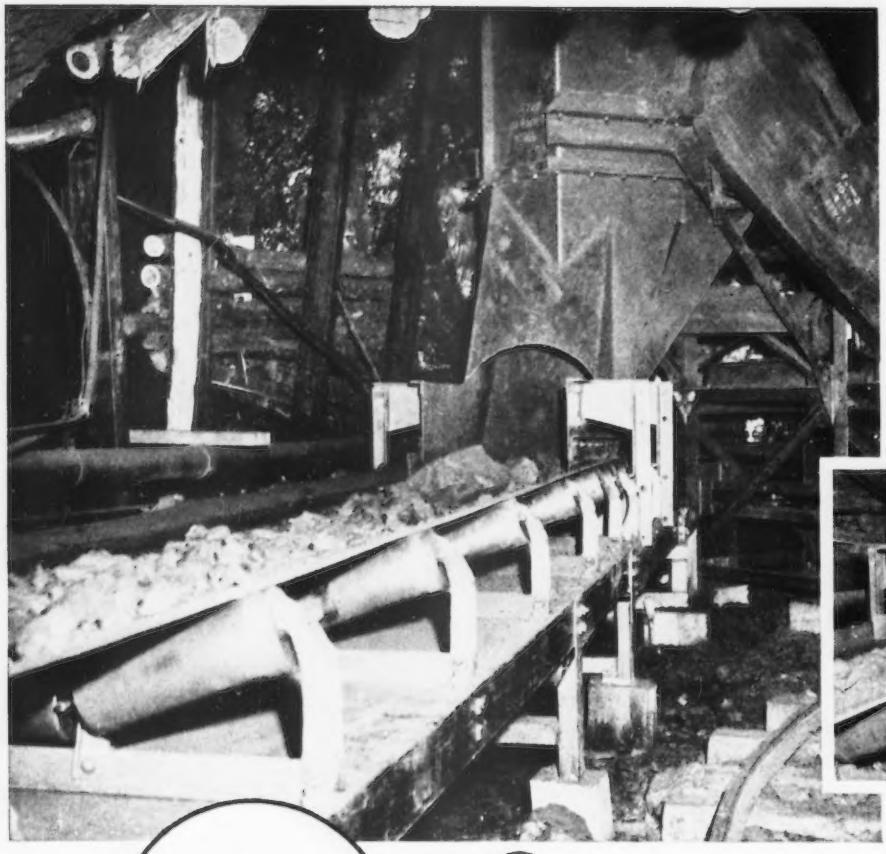
AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL CORPORATION
GENERAL OFFICES: CLEVELAND, OHIO

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

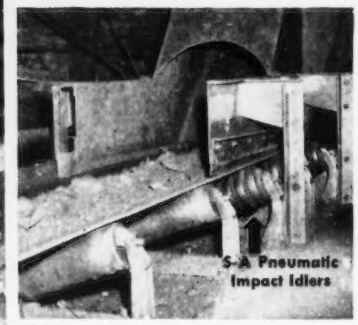
U·S·S AMERICAN TIGER BRAND WIRE ROPE

Excellay Preformed

UNITED STATES STEEL



S-A Belt Conveyors, 36" wide, carry iron ore from stopes to large ore pocket where it is hoisted to the surface. At all loading and transfer points, S-A Pneumatic Impact Idlers protect belt from impact of large lumps. Heavy duty Simplex Carriers are used to withstand shock of intermittent loading.



S-A Pneumatic Impact Idlers

148

S-A CONVEYING Systems move LOW TONNAGES, too, at LOWEST COST...

Here's proof that low tonnage mines can also cut costs with S-A conveyor installations. This 1700-foot belt conveyor system handles only 300,000 tons of ore per year. However, its installation was decided on only after careful analysis of a similar system installed in a larger mine in 1946. Anticipated economies have been verified by several years of operation.

S-A conveying systems may be the economical answer to your materials handling problems, too. Find out by calling in a S-A engineer. He has a complete line of equipment to draw upon. And, as a result of years of experience, he knows how to best use this equipment in meeting your specific requirements. Write for a free survey.

Belt Conveyors
Belt, Pan & Plate Feeders
Ship Loading Boom Conveyors
Stacking Conveyors
Storage & Reclaiming Systems
"Natural Frequency" Vibrating Conveyors
REDLER Conveyor-Elevators
ZIPPER Conveyor-Elevators
Conveyor Belt Cleaners
Headshaft Holdbacks
Grizzlies & Screens
Centrifugal Pilers
Bin Gates & Tunnel Gates
Car Pullers & Spotters
Bucket Elevators
Skip Hoists
SEALMASTER Ball Bearing Units

• Write for a bulletin on any of the above

STEPHEN S-A ADAMSON MFG. CO.

4 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif., Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

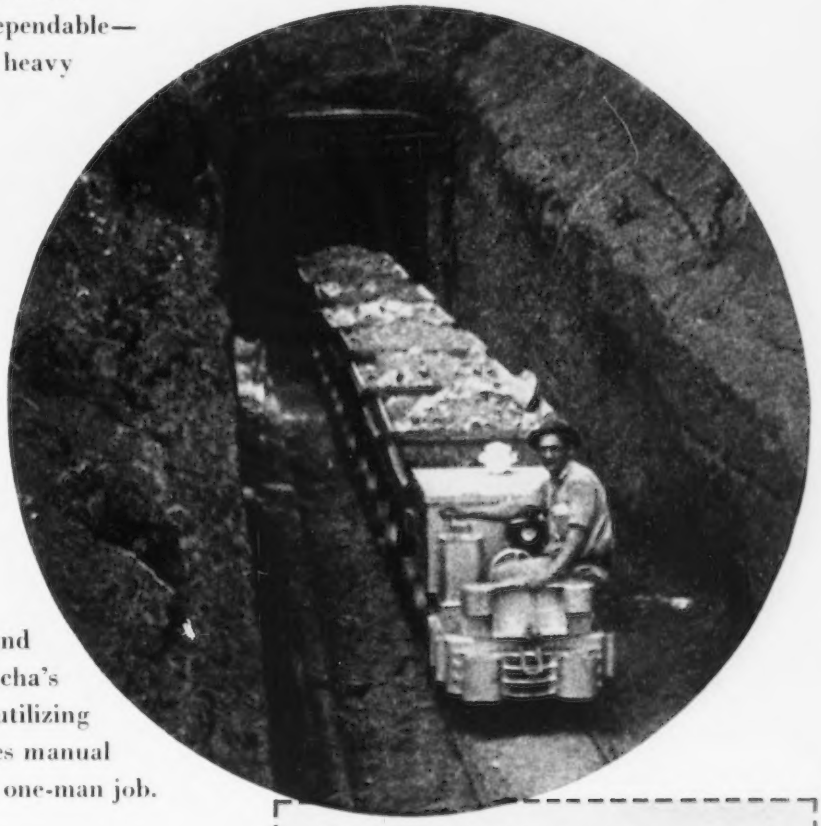
When mining men talk profit...

they talk about

MANCHA

STORAGE BATTERY LOCOMOTIVES

From experience they know Mancha locomotives are thoroughly dependable—engineered to stand up under heavy hauling assignments year-in, year-out with minimum maintenance.



They've learned from experience the advantages of Mancha chassis design: *Strength without excess weight.* It means extra battery power is available to move payloads.

They approve Mancha's patented Trackmaster design that levels out rough track—prevents derailment and lost time. And they like Mancha's time-saving battery change, utilizing a transfer rack that eliminates manual labor, and makes changing a one-man job.

In short, mining men like Mancha Storage Battery Locomotives for reasons that mean *extra profit.*

Find out what a Mancha can do for you. Write for our mine haulage Data-Form—*today.*

Mancha Storage Battery Locomotive
Division GOODMAN Manufacturing Company
4850 South Halsted Street, Chicago 9, Ill., U.S.A.

E&MJ-753

Send your mine haulage Data-Form

NAME.....

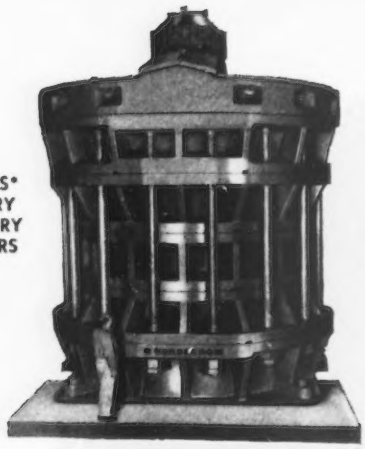
FIRM.....

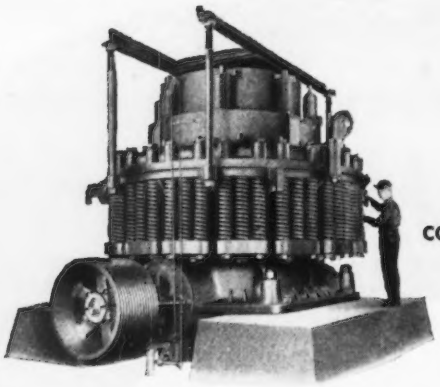
ADDRESS.....

CITY.....ZONE.....STATE.....

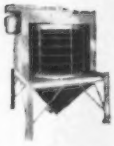
MANCHA STORAGE BATTERY LOCOMOTIVE
Division **GOODMAN** *Manufacturing Company*
4850 SOUTH HALSTED STREET CHICAGO 9, ILL., U. S. A.

SYMONS* PRIMARY GYRATORY CRUSHERS





SYMONS* CONE CRUSHERS



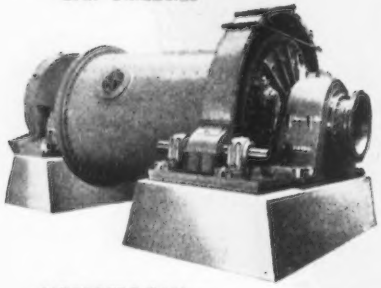
SYMONS "V" SCREENS for extremely fine separation

SYMONS* VIBRATING SCREENS

SYMONS* VIBRATING BAR GRIZZLIES

SYMONS* VIBRATING ROD GRIZZLIES

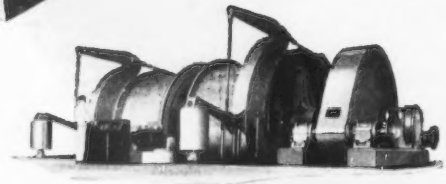
NORDBERG
MINING MACHINERY
... the leading choice of producers THE WORLD OVER



NORDBERG BALL—TUBE and ROD MILLS for wet and dry grinding

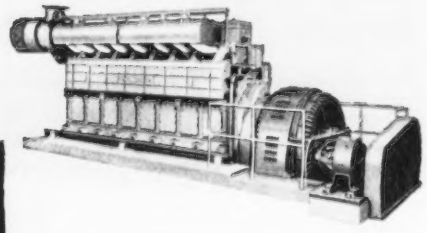
It is highly significant that wherever ores are found in quantity — efficiency-minded producers are now using, or are in the process of installing, Nordberg Mining Machinery . . . to assure maximum and continuous production at low operating and maintenance costs.

Write for literature on the machinery you need.



NORDBERG MINE HOISTS

NORDBERG DIESEL— DUAFUEL® and SPARK-FIRED GAS ENGINES from 10 to over 10,000 H.P. in a single engine.



M153 **NORDBERG MFG. CO., Milwaukee, Wisconsin**

NORDBERG MACHINERY **NORDBERG** CRUSHERS SYMONS SCREENS NORDBERG

MACHINERY FOR PROCESSING ORES and INDUSTRIAL MINERALS

NEW YORK • SAN FRANCISCO • DULUTH • WASHINGTON • TORONTO
MEXICO, D.F. • LONDON • PARIS • JOHANNESBURG

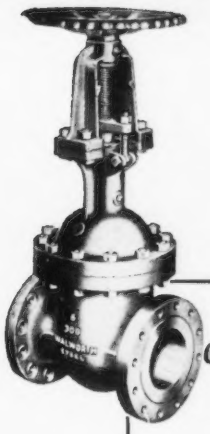
*SYMONS . . . A REGISTERED NORDBERG TRADEMARK KNOWN THROUGHOUT THE WORLD

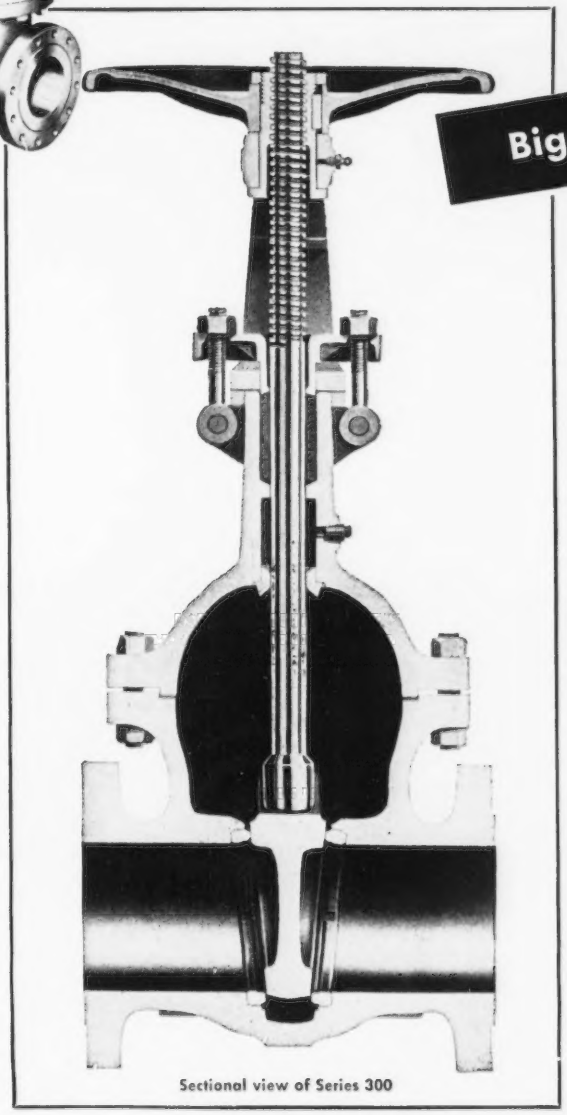
WALWORTH

Cast Steel Gate Valves

Series 150 and 300

Wedge Gate — Outside Screw and Yoke





Sectional view of Series 300

Big 8-Point Superiority!

Gland clearances are such that stem cannot be scored if gland should be tightened unevenly.

Deep Stuffing Boxes in all sizes (2" to 24") insure tightness and maximum packing life — costly leaks are eliminated.

Bonnets and Bodies are engineered to withstand pressure and minimize distortion — they're tough, durable, dependable.

Heavy Steel Walls provide extra strength and longer life.

Integral Body Guide Rib Faces are machined to insure accurate disc seating.

Seat Rings are bottom seated — not flange type. No recess exists at back of ring — hence no turbulence, erosion, or pressure drop.

Streamlined Ports allow high velocity, non-turbulent flow, and reduce the possibility of erosion.

Valves regularly have flanged ends. They can be supplied with ends for butt welding. Roller bearing yokes are available. On valves 5 inches and larger, by-passes can be furnished.

For Series 600 and higher, we recommend Walworth Pressure-Seal Steel Gate Valves.

For further information on Walworth Cast Steel Gate Valves, see your local Walworth distributor, or write:

WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

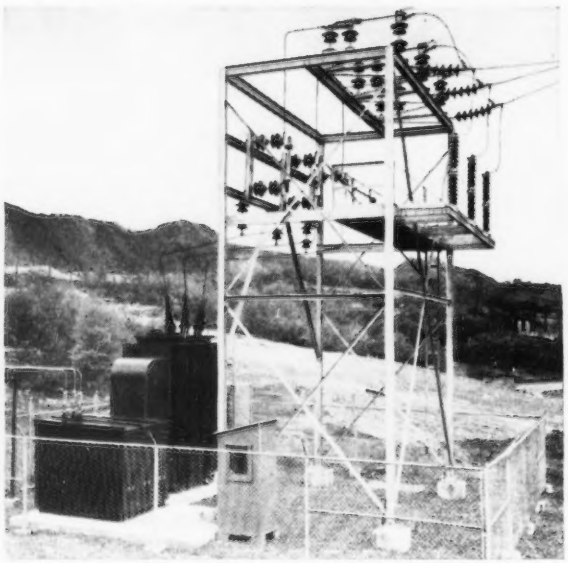
ENGINEERING REPORTS:

Photograph courtesy of Kennecott Copper Corporation

1 STEP UP SHOVEL SPEED, CAPACITY. This shovel performs faster, more smoothly, thanks to its simple, rugged G-E drive system. Usable torque is increased. Response and acceleration are improved. Amplidynes, which control shovel motions precisely, prevent excessive current and torque peaks which might damage electrical and mechanical equipment.

5 ways modern electrification can

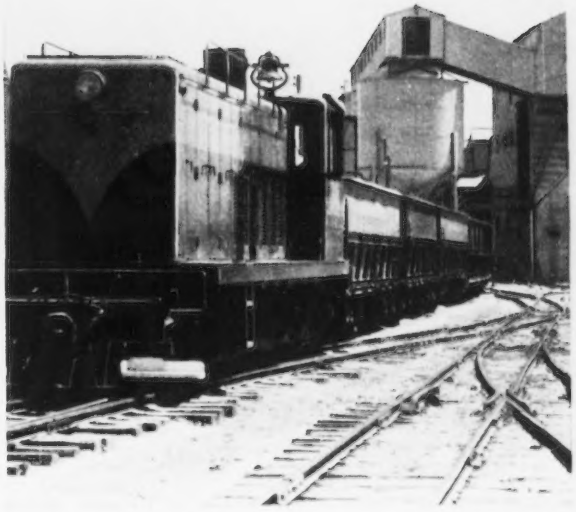
4 MAKE POWER SYSTEM MORE FLEXIBLE. This standard G-E cable-skid switch house has polarized couplers to simplify and speed up cable interchanging. Skid house is easy to move.



5 IMPROVE POWER SYSTEM PROTECTION. Magne-blast breakers in G-E master unit substation protect feeders; lightning arresters help guard substation against outage.

2 **INCREASE DRILL FOOTAGE.** This self-contained churn drill, powered by G.E., delivers rapid rock penetration promoting more efficient drilling and blasting practices.

1876 **75** 1953
YEARS OF ELECTRICAL PROGRESS



3 **HAUL MORE ORE.** General Electric 70-ton diesel-electric locomotive has high availability. It maneuvers rapidly, efficiently, helps speed all switching operations.

help you mine more tons per day

G-E engineered electrical systems mean faster open pit mining at less cost

You need speed, flexibility, and safety in your open pit mining operations if you are to meet present demands for higher production per man-day. *Modern electric power* is the key. Here's what it helps you to do.

1. You can speed up the digging cycle. G-E amplidyne-controiled drives provide faster hoist, swing, and crowd action on power shovels. Shovels work around the clock with minimum time lost for maintenance or repairs.

2. You can step up drilling efficiency. Modern rotary and churn drills, powered by General Electric, are self-propelled. Smooth, fast motor control helps them to drill harder rock at higher speeds.

3. You can haul greater tonnages. G-E diesel-electric locomotives withstand hard work cycles. Units can be operated close to the wheels' slipping point even with heaviest loads.

4. You can cut re-location time. G-E cable-skid switch houses give a more flexible power system arrangement. Moving is simplified. Cable connecting time is minimized.

5. You can increase mining efficiency and safety with portable G-E unit substations. They improve voltage levels—make full equipment capacity available. Distribution losses are reduced. Grounding systems help protect personnel and equipment.

These production-boosting techniques can be applied to your surface mining operation. A G-E mining industry specialist can show you how. Contact him at your nearest G-E Apparatus Sales Office. General Electric Company, Schenectady 5, New York.

660-29

Engineered Electrical Systems for the Mining Industry

GENERAL ELECTRIC

"I always choose my Primacord as carefully as I use it . . .

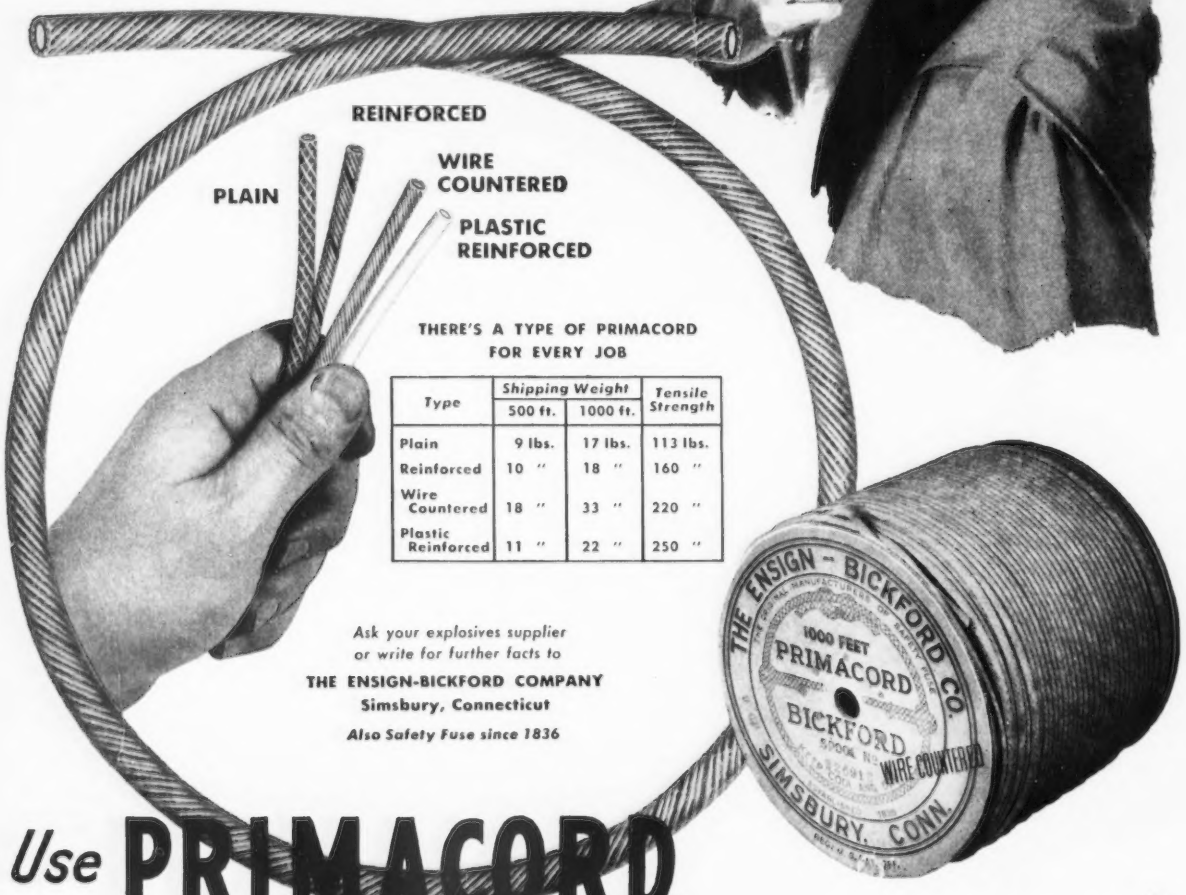
"I've used Primacord to shoot over-burden, ore, rock – and to ditch and clear right-of-way all-over the country. I get good results every time because I choose my Primacord as carefully as I use it.

"Plain Primacord I put down in small-bore or shallow holes, and also use it for the trunk line to hook them up. It's strong, light in weight, and economical. It's easy to tie tight to make a good connection.

"Reinforced Primacord is good insurance where I'm loading deep holes. It'll carry more weight and has a tougher cover to resist abrasion and cutting.

"Wire Countered Primacord is bound with fine wire. I always use it if I think there's any danger of sharp rocks or heavily reinforced explosives containers cutting the Primacord.

"Plastic Reinforced Primacord has a tough, waterproof plastic cover. I've used it in river crossings, in deep holes, or where field shots must stand a long time before blasting. It will take a lot of punishment, and is not affected by high summer heat or winter cold."



THERE'S A TYPE OF PRIMACORD FOR EVERY JOB

Type	Shipping Weight 500 ft.	Shipping Weight 1000 ft.	Tensile Strength
Plain	9 lbs.	17 lbs.	113 lbs.
Reinforced	10 "	18 "	160 "
Wire Countered	18 "	33 "	220 "
Plastic Reinforced	11 "	22 "	250 "

Ask your explosives supplier or write for further facts to

THE ENSIGN-BICKFORD COMPANY
Simsbury, Connecticut

Also Safety Fuse since 1836

Use PRIMACORD®

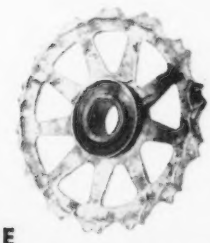
P-1

The PROVED and APPROVED DETONATING FUSE

Pacific Replacement Parts are interchangeable with original factory parts. Made of manganese steel or heat-treated alloy steel. Heavily reinforced – users report three- to four-times longer life. Customers served as long as 30 years keep repeating – that's proof of dependability.

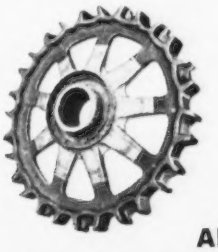
PACIFIC RENEWABLE SPROCKET RIMS

When sprocket rims wear out, don't throw away valuable spokes and hubs. Simply weld on new Pacific Manganese Steel Sprocket Rims and be dollars ahead. Idler wheel rims, too. Any welder can do the job. Send for Bulletin 217. - E.



BEFORE

Don't throw away hubs and spokes because sprocket rims are worn like this.

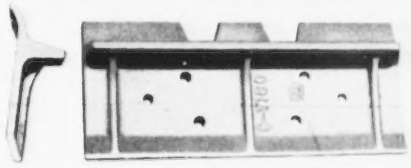


AFTER

Weld on new Pacific Manganese Steel Sprocket Rims and be dollars ahead.

TRACTOR GROUSER SHOES

Users report they last three- to four-times longer, thanks to reinforced design and superior, heat-treated alloy steel. Available for most leading makes of crawler type tractors.



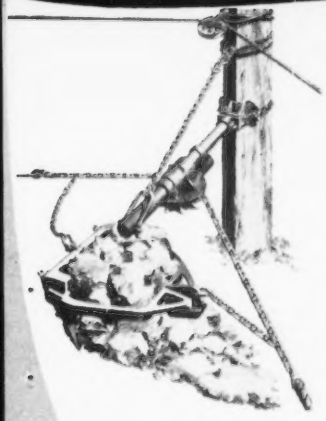
OTHER PACIFIC REPLACEMENT PARTS

Dozer Corners, Street Pads, Shovel Track Shoes, Crusher Jaws, Mantels and Concaves – Many Others.

Dependable Performers ABOVE GROUND

PACIFIC PRODUCTS

Dependable Performers UNDERGROUND

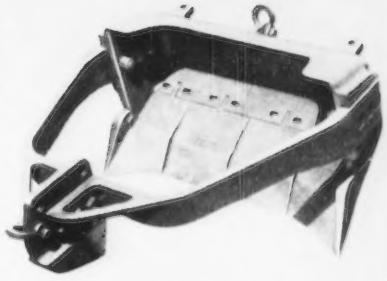


Pacific Mining Products are used around the world. Designed by mining men who know underground operations. Their superiority is maintained by constant study of the equipment at work plus rigid quality control of production of tough, wear-resistant alloy steel components.

"ROUND-THE-CORNER" SHEAVE BLOCKS

(U.S.A. and Foreign Patents Applied For)

Cut the cost of many mucking operations in half. Eliminates double-slushing. With RTC a two-drum hoist can pull a "Slushmaster" around any turn above 90-degrees. For action pictures showing method of operation, send for Bulletin No. 232. – E.



PACIFIC "SLUSHMASTER"

(U.S.A. and Foreign Patents Applied For)

They dig in, secure a full load in a single pass and then carry it with less horsepower. Ride on runners on backhaul. Easy disassembly. Nine models from 26" to 60" widths – capacities from 8 to 51 cu. ft. Write for Bulletin No. 215. – E.

PACIFIC SHEAVE BLOCKS

Simple – Rugged – Durable. Complete line with models to suit every cable size, every operating requirement. Manganese steel wheels and side frames. Roller bearings. Available with hook, shackle and safety swivel shackle suspensions. Send for Bulletin No. 238. – E.

OTHER PACIFIC MINING PRODUCTS

Jaw Crushers, Sizes: 6" x 12" to 10" x 30", Manganese Steel Crusher Jaws, Sheave Anchors, Bit Knockers.

ALLOY STEEL & METALS CO.

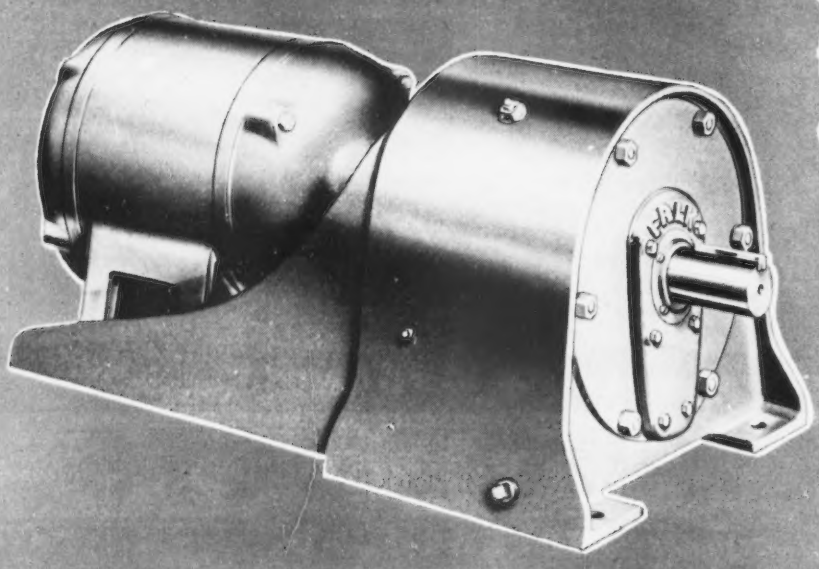
1848 EAST 55TH STREET, LOS ANGELES 58, CALIFORNIA

Mailing Address: BOX 15323 VERNON STATION, LOS ANGELES 58, CALIFORNIA

Choose the All-Motor type,

ALL-STEEL FALK Motoreducer

...with complete foot-mounted motor of ANY make — ANY type — ANY speed



Its exclusive, superior features mean LONG-RANGE ECONOMY!

You get more for your money in a FALK all-steel, All-Motor type Motoreducer. Here is the *only* compact motorized reducer with a separate foot-mounted, resilient Steelflex coupling-connected, standard motor without modifications! It accommodates *any* make, type, or speed of motor within the AGMA rating of the unit. Ratio can be changed within torque capacity of unit without modifying motor.

The simplified construction of the FALK All-Motor type Motoreducer means real long-range economy. Motors or reducer units can be quickly and easily interchanged from one line or plant location to another. Fully standard replacement motors from manufacturers' field stocks are always available without costly delivery delays or special motor or shaft modifications.

When you choose a FALK All-Motor type Motoreducer, you get the utmost in design, versatility of performance, and utility—plus the greatest possible dollar-for-dollar value throughout its traditionally long life... Available in any standard ratio from factory and distributor stocks throughout the country. Write for Bulletin 3104.

FALK ...a good name in industry

THE FALK CORPORATION 3001 W. Canal St. Milwaukee 8, Wis.

Every FALK motoreducer has these "IN-BUILT" FACTORS

1 **All-steel Housings.** Unbreakable, strong, rigid. Generous overhung load capacities provided by wide bearing spans, large shafts and bearings.

2 **Streamlined inside and outside.** Smooth, clean surfaces; machine welded construction conforms to NEMA motor frames.

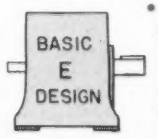
3 **Sealed Housings.** Dual closures and one-way vents keep oil *in*, dust and moisture *out*. Units are splashproof, leakproof, dustproof.

4 **Positive Lubrication.** Large sump capacity ...oil-tight construction assures clean lubricant...direct dip of revolving elements provides positive lubrication at all speeds.

5 **Wide Speed Range.** Selective ratio combinations provide output speeds from 1.5 rpm to 1430 rpm with stock gears.

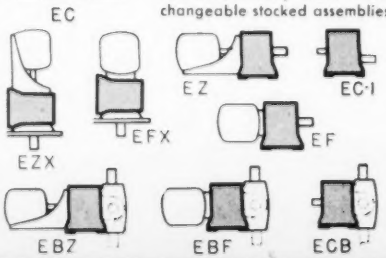
6 **Precision Gearing.** Heat-treated alloy steel, precision cut and shaved helical gearing throughout...quiet-operating crown shaved pinions...taper bored gears for easy ratio changes.

• • •



EC

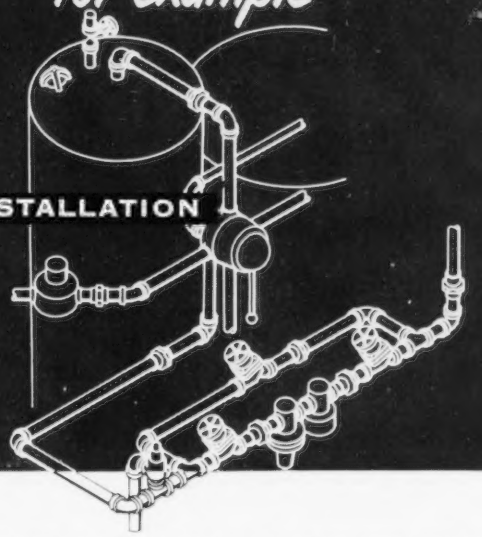
The basic E design permits maximum use of standardized parts . . . closer control over materials, processing, inspection and assembly . . . resulting in faster delivery from interchangeable stocked assemblies.



WRITE FOR BULLETIN 3104

This Valve Stops the "Up" in Upkeep ...on Water Service Piping, for example

THE INSTALLATION



At the Excello Paper Products Co., Inc., Cincinnati, using Crane Diaphragm valves on city water supply lines; also on plant service water piping, hot and cold.

VALVE SERVICE RATINGS

SUITABILITY:
Doing what other valves couldn't

FEATURES:
Packless - Long Life Diaphragm

MAINTENANCE COST:
No regular maintenance needed

SERVICE LIFE:
Outlasting other valves many times

OPERATING RESULTS:
Safety hazard to personnel stopped

AVAILABILITY:
Crane catalog item - No. 1610

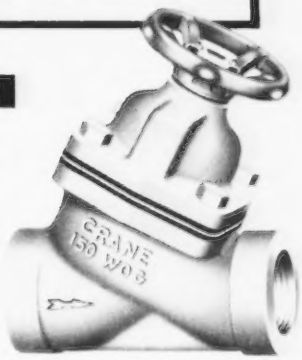
THE CASE HISTORY

Typical of many processes using a lot of water, this plant has numerous open end lines and hose connections. And because of very frequent operation, the valves formerly used in these lines required more than usual servicing to keep up with leakage, dripping hose lines, and hazardous, messy floors.

Crane No. 1610 Diaphragm valves were selected to replace the troublesome conventional valves. Immediately these packless valves stopped the annoyance and expense of stuffing box and seat leakage. Their pliable disc insert ring made a tight seat on open end lines with minimum effort on handwheels.

The replacements were started about 2 years ago. With no attention whatsoever, all Crane Diaphragm valves remain tight, and the plant's water leakage problem remains solved.

THE VALVE



Water is but one of hundreds of fluids Crane Packless Diaphragm valves handle efficiently. Their sealed-to-fluid bonnet and "soft-seating" disc are ideal for all sorts of hard-to-hold liquids and gases; also for sludges, slurries, etc. Separate disc and diaphragm design saves diaphragm wear; permits tight seating even should diaphragm fail. Choose these valves from a wide range of materials, lined or unlined body, for corrosive or ordinary applications. See your Crane Catalog, or your Crane Representative.

THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

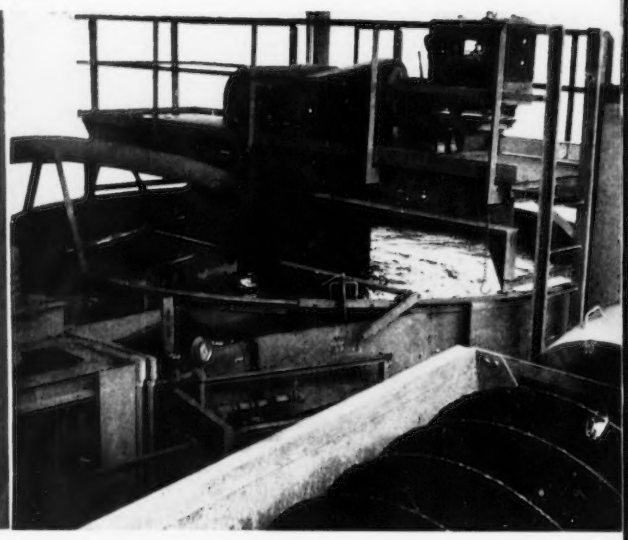
CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

Another Example of
Profitable Non-Metallic Beneficiation
with Heavy-Media Separation

Read How
Kaiser Aluminum and Chemical Corporation Up-grades Dolomite, Reduces "Selective Shoveling," Increases Output and Improves Quarry Efficiency with this pre-fabricated H.M.S. Plant



Kaiser Aluminum and Chemical Corporation imposes a very tough specification on its Nativadad (California) Dolomite Plant—less than 1% silica and not less than 98% dolomite from a deposit of dolomitic limestone intruded by large dikes and sills of high-silica granite!

To produce acceptable kiln-feed it had been necessary to by-pass large dikes and sills or to mine out and discard these high-silica intrusives as waste. "Selective shoveling" made quarrying operations, difficult, costly. At one time, only 38% of the mined material was usable. Beneficiation, too, posed a problem because the specific gravity of acceptable product is within 0.10 of the high-silica waste.

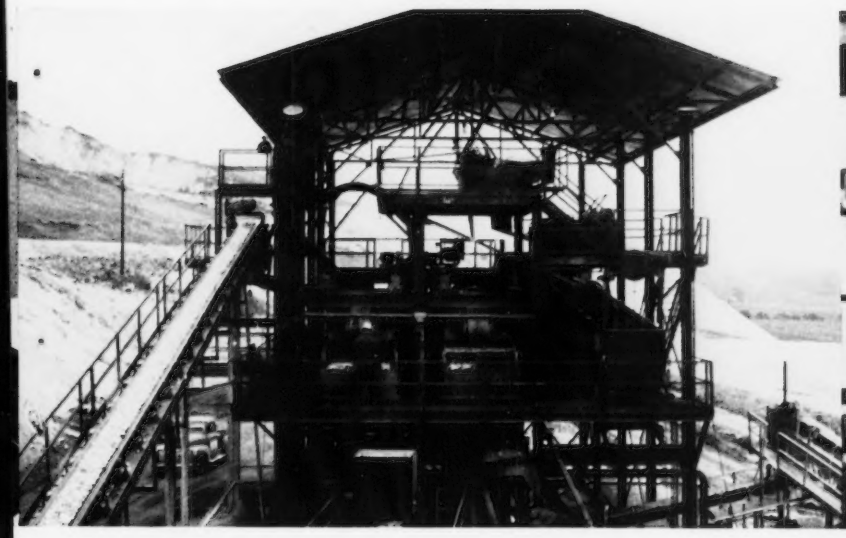
To solve this difficult operating and economic problem, Kaiser installed a 250 tph Heavy-Media Separation plant. Result: A more uniform, low-silica product; better kiln operation, and lower costs all along the line. Typical analyses of end product now show silica approximately 0.3% from a feed running as high as 7.7% and averaging 2.7 SiO_2.

Over 55% of the quarry output now becomes usuable kiln feed . . . a marked gain in quarry efficiency. Ore reserves have been increased. Lower-grade material can now be beneficiated. "Selective shoveling" has been materially reduced with concurrent gains in output and quarry costs.

Treating 4 x ¼" feed with a ferrosilicon-magnetite mixture as the separating medium, this pre-fabricated Heavy-Media Separation plant operates at 2.65 specific gravity. Medium-loss averages well under a half-pound per ton of kiln-feed recovered. Capital costs were minimized by pre-fabricated construction. Operating and labor costs are low.

AMERICAN Cyanamid COMPANY

MINERAL DRESSING DIVISION 30 ROCKEFELLER PLAZA NEW YORK 20, NEW YORK



This is but one of many examples of non-metallic minerals now being beneficiated by Processes and Reagents offered by Cyanamid. Quickly and at low capital cost, you may be able to improve output, cut costs or make "sub-marginal" deposits workable through accurate, low-cost concentration employing one of these processes.

Cyanamid offers a choice of processes covering a full size-range: Heavy-Media Separation, 6 x ¼"; Dutch States Mines Cyclone Separator, ⅜" x 65 mesh, and Froth Flotation, 65 mesh x 0. Test results, design data and operating experience are available to assure predictable performance in minimum time at the lowest cost.

First step to more profitable operation is a discussion of your problems and objectives with a Cyanamid Field Engineer. Your letter or telephone call – or the convenient coupon – will have prompt and intelligent attention.

☐ *We are interested in data on the beneficiation of the non-metallic minerals ringed below:*

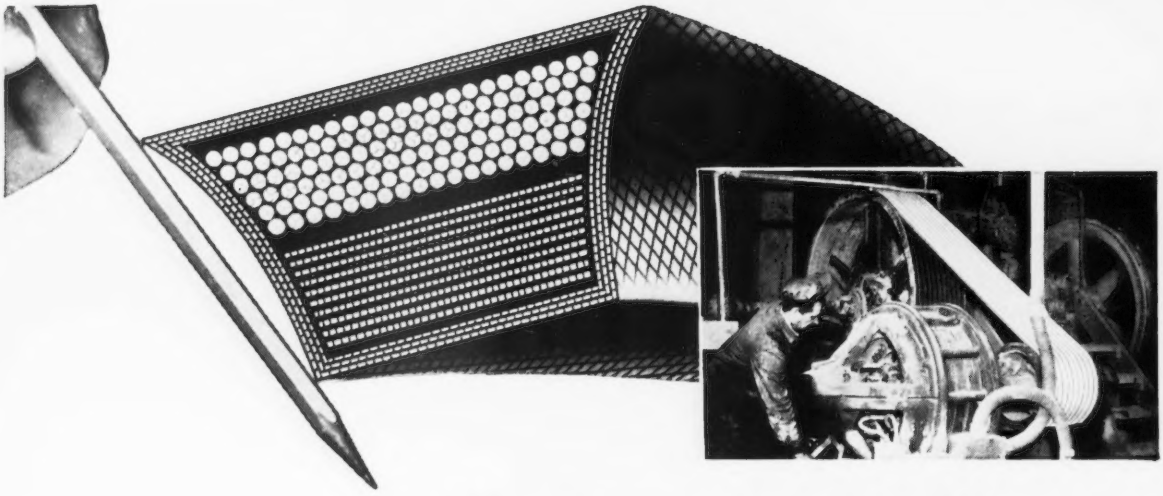
ANDALUSITE	FLUORSPAR	KYANITE	RHODOCHROSITE
BARITE	GARNET	MAGNESITE	SALT
CEMENT ROCK	GLASS SANDS	MANGANESE	SILLIMANITE
COAL	GRAPHITE	MICA	SCHEELITE
CHROMITE	GRAVEL	OLIVINE	SPODUMENE
DIAMONDIFEROUS GROUND	GYPSUM	PEARLITE	VERMICULITE
	ILMENITE	PHOSPHATE ROCK	WOLFRAMITE
FELDSPAR	IRON OXIDES	POTASH	(OTHER)

☐ *Send a copy of "Mineral Dressing Notes #19 – Heavy-Media Separation Processes for Mineral Concentration"*

Name _____

Address _____

PRINTED IN U.S.A.



Gates V-Belts are built with CONCAVE SIDES

(U.S. PATENT NO. 1813698)

...that's why they last longer!

If you want lower V-Belt costs, just make this simple test...pick up *any* V-Belt and bend it as if it were going around a pulley.

As the belt bends, grip its sides between your fingers and thumb.

If the belt has *straight sides* you feel the sides bulge out. This forces the sides of the belt to press *unevenly* against the V-pulley . . . and you get concentrated wear at the points shown by the arrows.

Now, try this same test with the V-Belt that is built with CONCAVE SIDES —the Gates Vulco Rope.

As this belt bends, you can feel the CONCAVE SIDES *fill out* and become perfectly straight.

These sides press *evenly* against the V-pulley. All wear is distributed *uniformly* across the full width of the Gates Vulco Rope and the CONCAVE SIDES therefore mean longer belt life and lower V-Belt costs for you.

When you buy V-Belts, be sure to get the V-Belt with the CONCAVE SIDES—the Gates Vulco Rope!

Gates Engineering Offices and Jobber Stocks are located in all industrial centers of the United States and in 71 foreign countries.

CS-535

V-Belts—Hose Molded Rubber Goods for industry World's Largest Maker of V-Belts

Gates® VULCO ROPE DRIVES

THE GATES RUBBER COMPANY • DENVER, U.S.A.

Wire Rope at Work—Near Hazleton, Pa., lie rich seams of anthracite coal which in places are not far below the surface of the ground. The dragline excavator shown here, owned by A. E. Dick Contracting Co., is getting at the coal by stripping off overburden—the cover of earth that is about 120 ft in thickness at this particular point.

Using a 22-yd bucket, the excavator can scoop up thousands of cubic yards of dirt and rock per day. It works 'round the clock, with only minor interruptions. This mechanical mastodon is fitted throughout with Bethlehem Wire Rope, including twin draglines and hoist lines, visible in the picture as they handle the bucket. A typical assignment, the kind of rough, tough job entrusted to Bethlehem rope in every type of industry, wherever there is heavy lifting or hauling to be done.

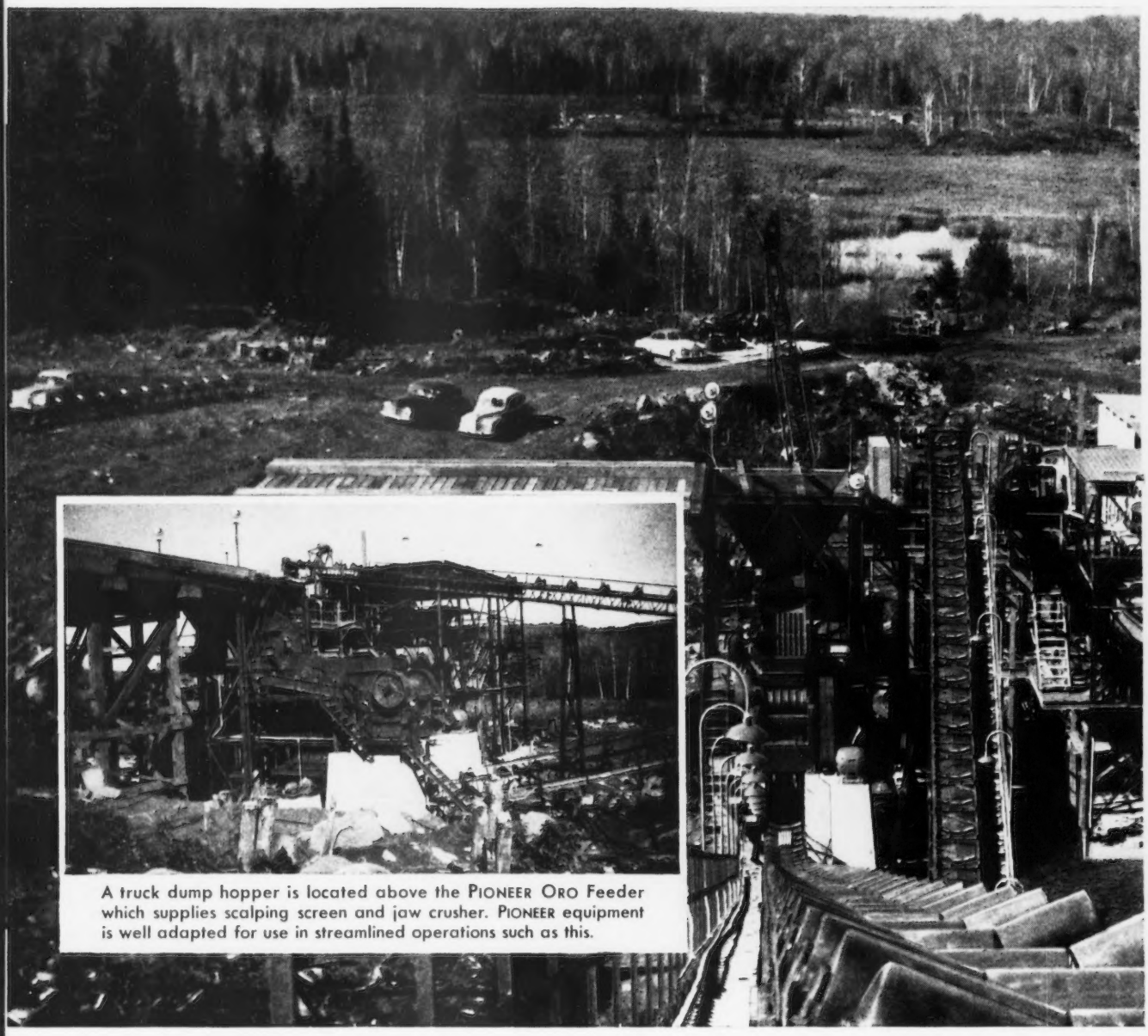
Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

Mill depots and distributors all over the country stock Bethlehem rope for the following industries and numerous others:

MINING • CONSTRUCTION • PETROLEUM • EXCAVATING • QUARRYING • LOGGING • MANUFACTURING

When you're opening a new mine . . .

that Pioneer Edge



A truck dump hopper is located above the PIONEER ORO Feeder which supplies scalping screen and jaw crusher. PIONEER equipment is well adapted for use in streamlined operations such as this.

BUY BOTH!
HIGHER OUTPUT
LOWER UPKEEP

Pioneer

Continuflo EQUIPMENT

keeps ore cost low

Cleveland Cliffs picks Pioneer equipment

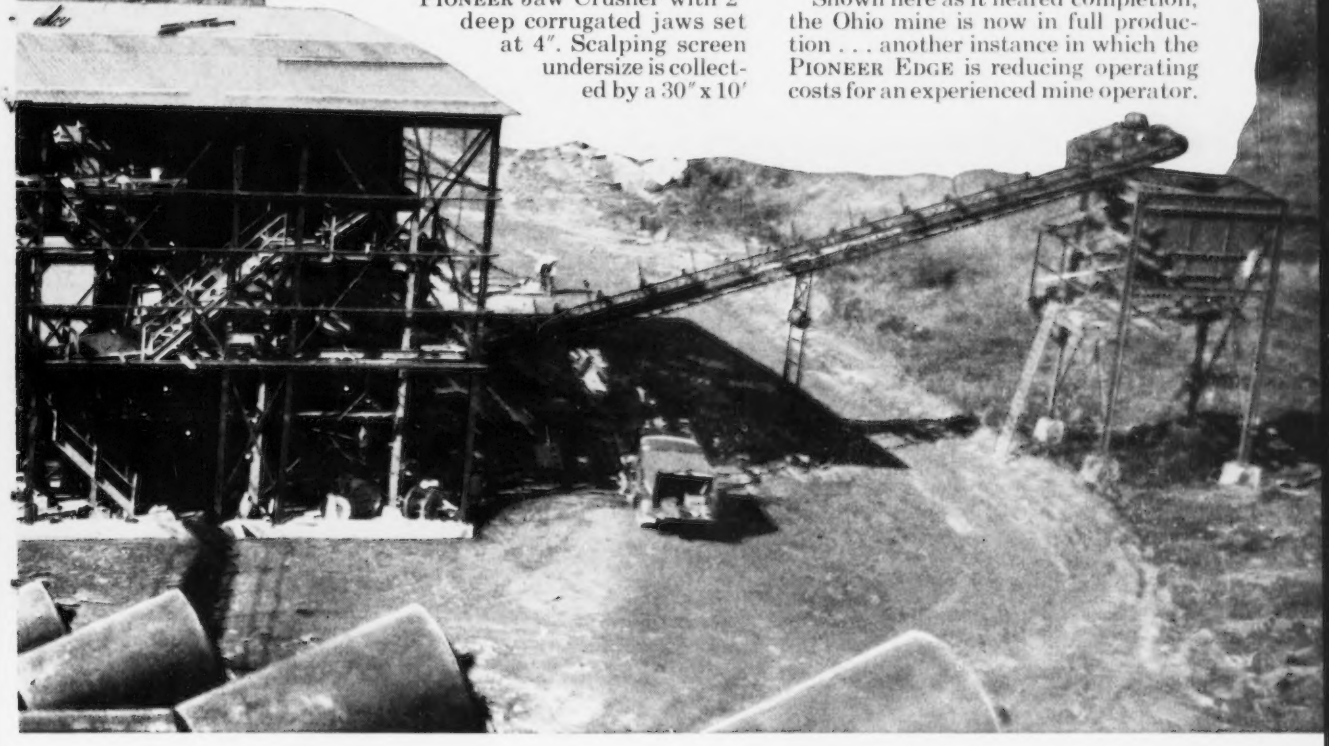
Today, cost-of-production is an important item in the mining business. It often makes the difference between profit or loss.

With this in mind, it is only natural that Cleveland Cliffs Iron Company should specify PIONEER equipment for its new 450 ton-per-hour Ohio mine, located near Michigamme, Michigan.

Here, pit-run material is delivered via a 48″ x 12′3″ PIONEER ORO Feeder to a 4′ x 10′ Mesabi-type scalping screen. Oversize goes to a 30″ x 42″ PIONEER Jaw Crusher with 2″ deep corrugated jaws set at 4″. Scalping screen undersize is collected by a 30″ x 10′ PIONEER Apron Feeder for delivery to a 30″ x 300′ stockpiling conveyor where it rejoins material from the jaw crusher.

Underneath the stock pile, a 30″ x 8′ PIONEER feeder supplies the 24″ x 288′ PIONEER SWS tunnel conveyor feeding the secondary crusher at the heavy density plant. There, still further PIONEER equipment is on the job, handling waste material, loading bins, etc. All conveyors are equipped with 6″ diameter Mesabi-type idlers.

Shown here as it neared completion, the Ohio mine is now in full production . . . another instance in which the PIONEER EDGE is reducing operating costs for an experienced mine operator.



Check with PIONEER

● Opening a new mine? Reviving an old one? In either case it will pay you to check with the company that's supplied more feeders, jaw crushers, and complete washing plants in the Lake Superior mining region *than all other manufacturers combined!*

For detailed information on equipment that will help *you* cut operating costs, write or mail the coupon today.

PIONEER ENGINEERING WORKS, INC.
1515 Central Avenue • Minneapolis 13, Minnesota
(SUBSIDIARY OF POOR & COMPANY • CHICAGO)

● Please send me information on the equipment checked.

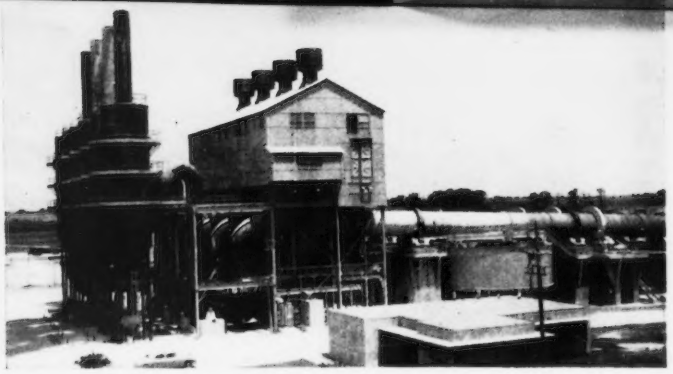
☐ JAW CRUSHERS	☐ GRAVEL PLANTS	☐ APRON FEEDERS
☐ ROLL CRUSHERS	☐ WASHING PLANTS	☐ MECHANICAL FEEDERS
☐ ROCK PLANTS	☐ BITUMINOUS PLANTS	☐ VIBRATING SCREENS
☐ ORO FEEDERS	☐ BITUMINOUS PAVERS	☐ CONTINUELO CONVEYORS

*Name*_____

*Company*_____

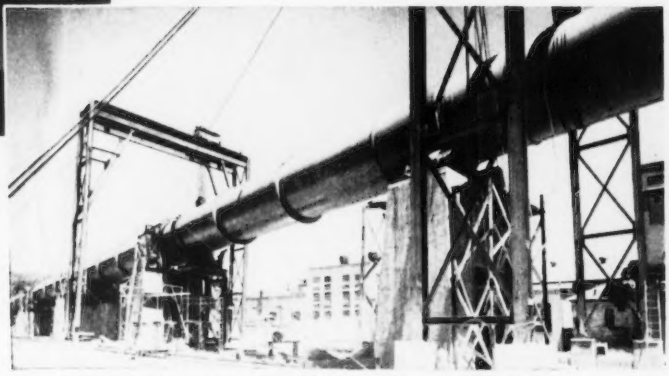
*Address*_____

*City*_____ *Zone*____ *State*_____



Baton Rouge, La. - 3 of 4 9'6" x 250'0" Traylor Kilns installed in the plant of a leading Cement Producer.

HAS BUILT 40 Rotary Kilns DURING THE PAST 2 YEARS



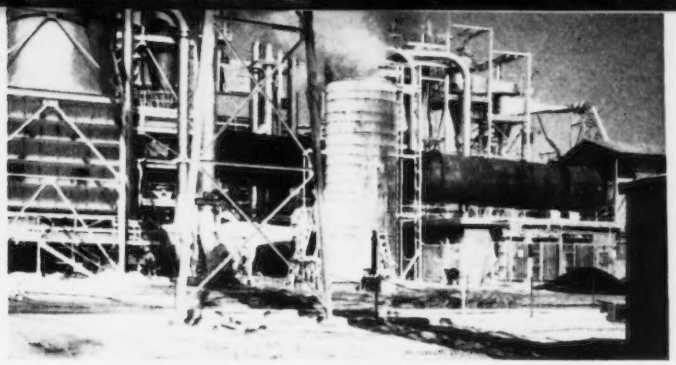
Covington, Va. - 11'0" x 350'0" Lime Kiln purchased by another leading paper maker for lime sludge recovery.

Palatka, Fla. - 7'0" x 200'0" Kiln in the plant of a paper manufacturer, used for lime sludge recovery.

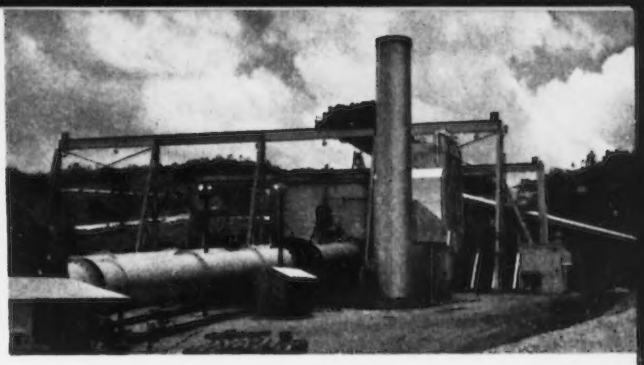
Each Kiln individually "Traylored" for the efficient production of one of the following 13 different products.

Lime • Titanium Oxide • Bauxite • Cement • Sodium Silicate
Dolomite • Iron Sulphide • Alumina • Sinter-Alumina • Calcium Chromate • Phosphate Rock • Lime Sludge • Diatomaceous Earth

A rotary kiln represents an important investment for any company. Leading producers all over the world have come to rely on Traylor's past experience to avoid future production headaches. Play it safe. Depend on the proven ability of Traylor engineers to assure the production you anticipate when expanding or modernizing your plant facilities.



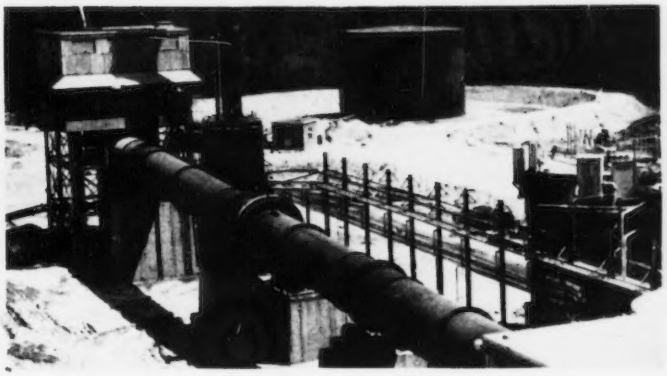
Lompoc, Calif. - An 11'0" x 100'0" Kiln producing Diatomaceous Earth.

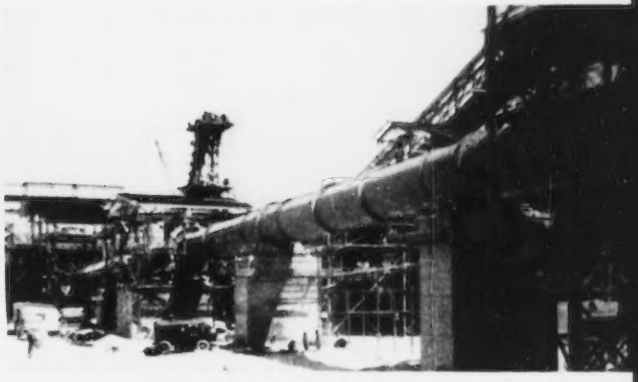


Jamaica, B.W.I. - 9'0" x 175'0" Traylor Kiln used in the processing of Bauxite.

Acme, N.C. - Traylor 8'6" x 215'0" Lime Sludge Recovery Kiln in plant of well known paper manufacturer.

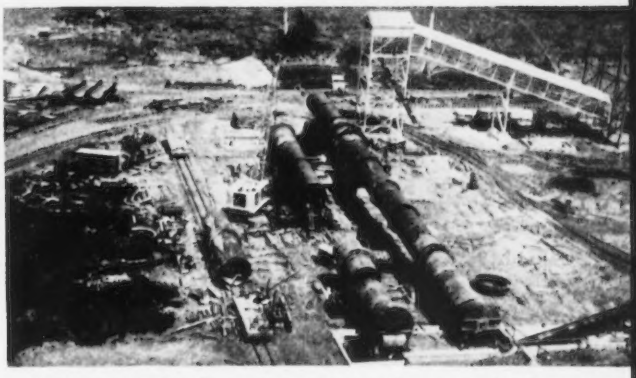
Chile, S.A. - 7'6" x 315'0" for calcining lime, used in the processing of copper ore.





ranging in size from 7′ diameter up to 11′ diameter x 400′ long

Gardanne, France - 9'6" x 250'0" Rotary Kiln installed in the modern alumina plant of a well known overseas company.



Suriname, S.A. - Two of many Traylor Kilns installed in Latin Ameri these 8'0" x 120'0" kilns will be used in the production of Alumi

A **Traylor** *Leads to Greater Profits*

York, Pa. - It took 7 flat cars to ship this 10' x 300', 3 section Traylor Kiln to this leading Dolomite producer.

Soon to be released! A new, fully illustrated, bulletin on Traylor Rotary Kilns is now in preparation. It will show the many superior features of Traylor Rotary Kiln design in detail. Mail the coupon today to be sure of getting up-to-date information you can't afford to miss.

Name: _____

Company: _____

Address: _____ *State:* _____

Title: _____

TRAYLOR ENGINEERING & MANUFACTURING CO.

592 MILL ST., ALLENTOWN, PA.

SALES OFFICES: New York • Chicago • San Francisco

Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P.Q.

FARVAL SPRAY VALVES save 95% of lubricant and do 100% better job

FARVAL—*Studies in Centralized Lubrication* No. 149

COUNT the number of open gears on your machines. Multiply the amount of grease required for these gears by 95% and you'll have the savings in lubricant alone which Farval Spray Valves can bring.

Even more important than lubricant saving, the Farval Spray Valve spreads and maintains a uniform thin film of oil or grease evenly over all bearing areas —eliminates friction, increases efficiency, lowers power costs, reduces wear.

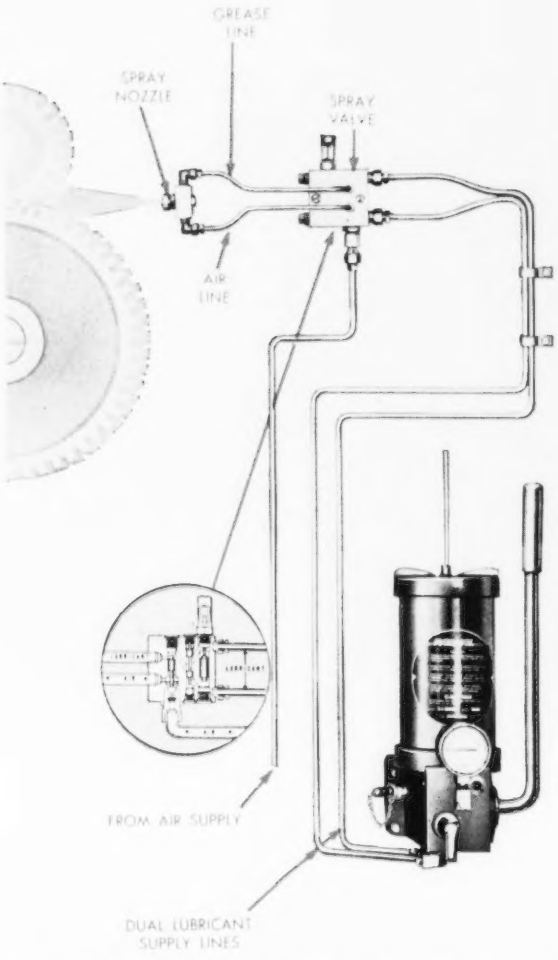
The Farval Spray Valve System is designed especially for lubricating open gearing and slide surfaces. Using an adaptation of the familiar Dualine Valve, this system sprays oil or grease from nozzles in just the right amount and at any desired interval.

No more wasteful hand paddling of lubricant on gear teeth with the hope it will spread itself uniformly. No more blobs of grease splotching up the floor—creating safety hazards. The Farval Spray Valve System has proved it can maintain a clean, even film of lubricant at all times while machines are in operation. No waste. No mess. No trouble.

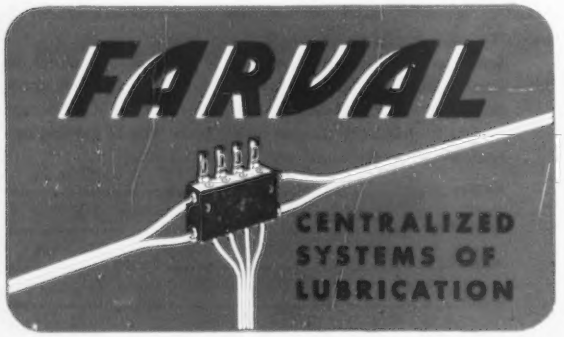
Farval Spray Valves can be inserted in a regular Farval Dualine System wherever compressed air is available. Or a complete Farval Spray Valve System may be installed, consisting only of Spray Valves served by a manual or automatic pumping unit. As indicated in the sketch at right, compressed air is directed through the Spray Valve, which meters air to the delivery nozzle at the same time that the lubricant is metered. Positive cut-off after delivery eliminates bleeding.

Why not insure that your open gearing and slide surfaces get the lubrication they need? Write for a copy of Farval Spray Valve Bulletin No. 60 today. The Farval Corporation, 3281 East 80th Street, Cleveland 4, Ohio.

Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.

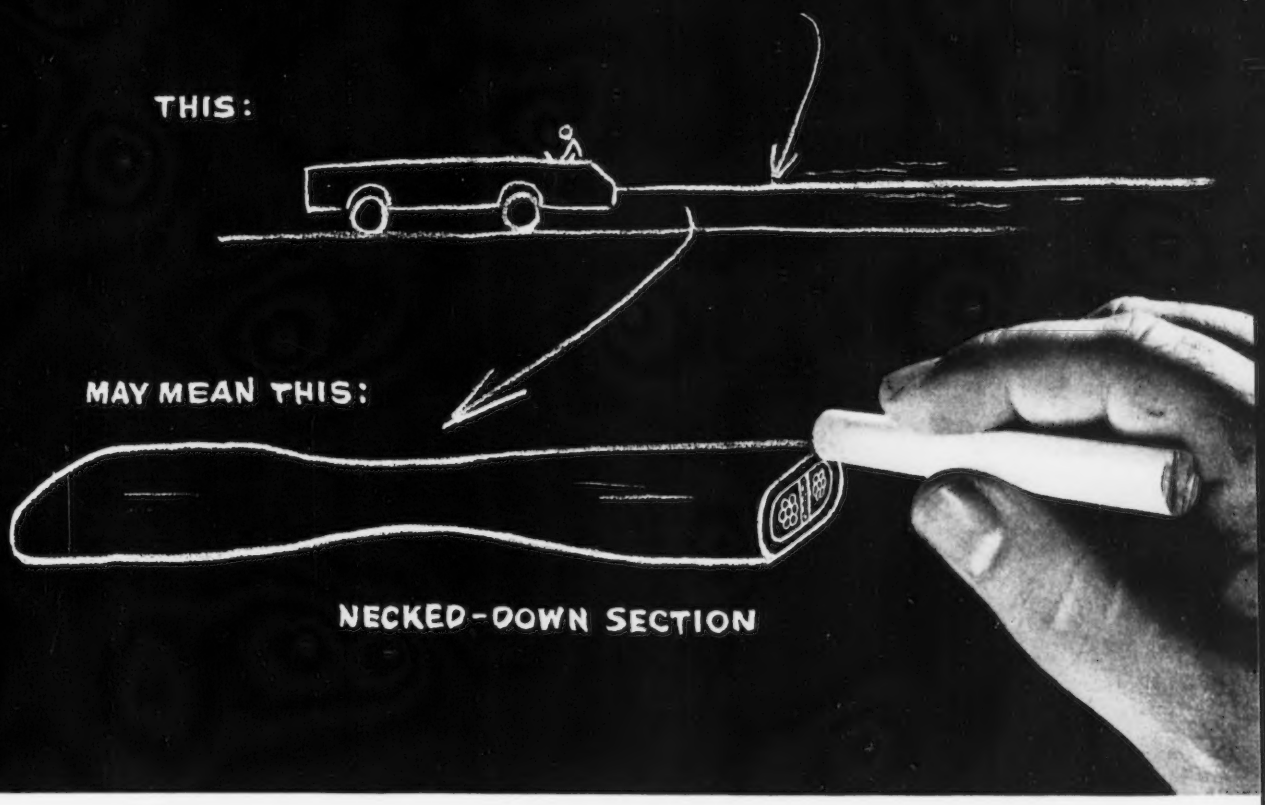


Drawing shows component parts of the Farval Spray Valve Centralized System of Lubrication—manual pumping station, dual lubricant lines, compressed air line, single Spray Valve and nozzle. Both automatic and manual systems installed three years ago are in operation today, prolonging gear life, saving labor and lubricant.



MINING MACHINE CABLE

HOW TO SPOT DAMAGE FROM TOO MUCH TENSION



. . . AND WHY ANACONDA'S NEW BALANCED DESIGN ADDS SAFETY, LONGER LIFE TO CABLE

Necked-down cable shows overstretching. Jacket and insulation become thin, easily punctured. Moisture penetration or a broken ground conductor may make the cable hazardous.

ANACONDA'S ANSWER: BALANCED DESIGN

Tension devices help; but aren't cure-alls. An added safeguard lies in the balanced design of Anaconda's new mining-machine cable. Stretchability of the ground has been increased. It will not break before the power conductors. A new neoprene jacket has higher compression-cutting resistance and tensile strength. In the insulation more strength and moisture resistance are obtained from a cold-rubber base . . . similar to that used by tire makers to mold a tougher tire. Stranding, too, has been redesigned to make the whole cable more flexible . . . at no greater cost. You get less trouble from tearing, cutting, gouging and abrasion caused by rib-pinching, runovers and dragging.

MUCH LONGER AVERAGE LIFE

In shuttle cars recently surveyed in 15 mines, ANACONDA Cables last 3 times as long as cables made only a few years ago. To learn why this is so, ask your nearest Anaconda Sales Office or Distributor for a sample section of this new cable. Examine it . . . take it apart. And remember that no ANACONDA Mine Cable has ever failed a U. S. Bureau of Mines flame test. *Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.*

ANACONDA®

TODAY'S HEADQUARTERS FOR MINE CABLE

FLAT-TWIN CABLES FOR:
shuttle cars
continuous miners
loaders cutters
drill trucks

HI-VOLT CABLES FOR:
mine power

TYPE SH-D FOR:
shovels

TYPE SO FOR:
hand drills
remote control

TROLLEY WIRE
FEEDER CABLES
TELEPHONE WIRE
SHOT-FIRE CORD
WELDING CABLES

It's time to change a famous name

. . . to make it easier for you to identify and specify J&L's High Tensile Steels.

. . . to make it easier for you to obtain combinations of:

- **High Strength**
- **Good Formability**
- **Low Temperature Impacts**
- **Resistance to Corrosion**
- **Resistance to Abrasion**

J&L's new JALTEN series replaces the famous Otiscoloy line and may be selected in the following combinations of advantages:

Jalten No. 1—High strength, good formability and fabricating—improved low temperature impacts.

Jalten No. 2—High strength, moderate forming—improved resistance to atmospheric corrosion.

Jalten No. 3—High strength, moderate forming—improved resistance to abrasion.

Jalten*

replaces

OTISCOLOY

J&L STEEL

JONES & LAUGHLIN STEEL CORPORATION
PITTSBURGH

This new Jalten book gives you complete information.

Send for your Copy...TODAY!

Features of this book show how Jalten can help you build better products:

- *Chemical Properties of Jalten*
- *Mechanical Properties of Jalten*
- *Jalten Equivalents*
- *Jalten Application Data*

JONES & LAUGHLIN STEEL CORPORATION
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Please send me a copy of "Jalten . . . the low alloy high strength steel."

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Company _____

Address _____

Stainless Steel

to meet the exacting challenges of

Ore Recovery—Rakes in this Dorr Classifier are Stainless Steel. This particular piece of equipment is used in acid leaching copper oxide and Stainless Steel has demonstrated excellent resistance to the highly acid leach solution.

is ready

"Mining's Greatest Era"

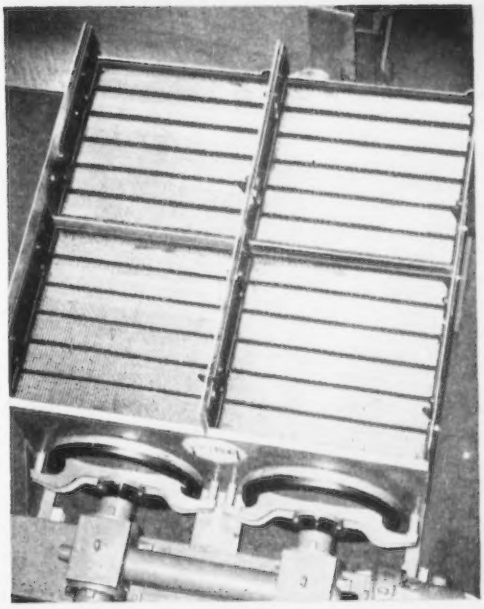
THERE's hardly an aspect of mining today where you won't find Stainless Steel equipment in use, helping to reduce costs through superior resistance to corrosion and abrasion.

Stainless Steel has found wide acceptance in ore dressing, in placer mining, in smelting and refining and in non-metallic mining, too. And with today's emphasis on new facilities and greater production, Stainless Steel is ready to take on even more important roles.

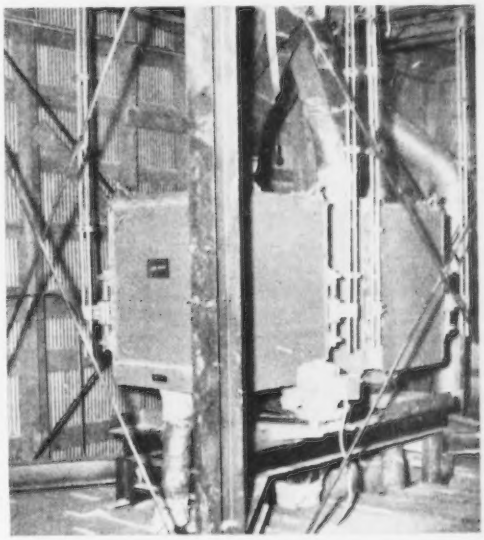
For example, chemical methods of ore recovery are attracting wide interest in the industry today. Although many of the developments in this line have not been publicly disclosed, it's a safe assumption that their very chemical nature will make them "naturals" for Stainless Steel.

That's because Stainless Steel—over a period of many years—has gained widespread acceptance in the chemical industry itself, handling a variety of materials under the most severe operating conditions. And the same characteristics demonstrated there can be used to advantage in recovery of ore by chemical methods.

Our representatives will be glad to work with you and your equipment manufacturers in applying U·S·S Stainless Steel where it will pay off in your operations. Perfected, service-tested U·S·S Stainless Steel is made to give you the finest performance. You can bank upon it now—and in the future.



Placer Mining—Stainless Steel screens in this Yuba Mineral Jig are exposed to continuous wear and corrosion. There is no blinding of screen openings that would result in frequent down time for cleaning and replacement.



Non Metallic Mining—Gyratory sifters in the dry mill of the Kings Mountain Mica Co., Kings Mountain, N. C. are equipped with Stainless Steel screens. These sifters are located in the dry mill where a bagged product is made to the customers' specifications.

UNITED STATES STEEL CORPORATION, PITTSBURGH · AMERICAN STEEL & WIRE DIVISION, CLEVELAND · COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH · TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. · UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S STAINLESS STEEL

SHEETS · STRIP · PLATES · BARS · BILLETS · PIPE · TUBES · WIRE · SPECIAL SECTIONS

3-1476

UNITED STATES STEEL

LOOK TO

for Outstanding Advances

Plus A Complete Line of Performance-

Simplex-Tirex Twin Shuttle Car Cables

Feature *Gear-Shaped* insulated conductors that firmly interlock with the jacket so that even continual twisting of the cable will seldom pull them out of position. They will not twist or override each other. The Selenium-Neoprene Armor is CURED-IN-LEAD for extra toughness. Marked P-101 BM. Available as Type W and Type G.

Simplex-Anhydrex XX Cables

High-voltage cables that assure uninterrupted service at 2,000-17,000 volts operation in underground, duct or aerial installations. Insulated with Anhydrex XX, first high-voltage insulation combining all the properties necessary for trouble-free operation when exposed to water and moisture, heat, ozone and other deteriorating agents. Jacketed with a special neoprene compound that provides steadfast protection against rough handling, soil acids and alkalies, oils, grease, chemicals and flame.

Simplex-Anhydrex Signal & Communication Cables

Light-weight, easily installed cables for telephone, signal and communication circuits. Protected by a special neoprene jacket. No metallic tapes necessary. Insulation has ideal electrical and physical characteristics for these uses.

Available as two-conductor or multi-conductor cables for telephone and communication service. These cables can also be used for block signaling as well as operating electric switch-throwing devices.

Simplex WIRES & CABLES

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Mass.

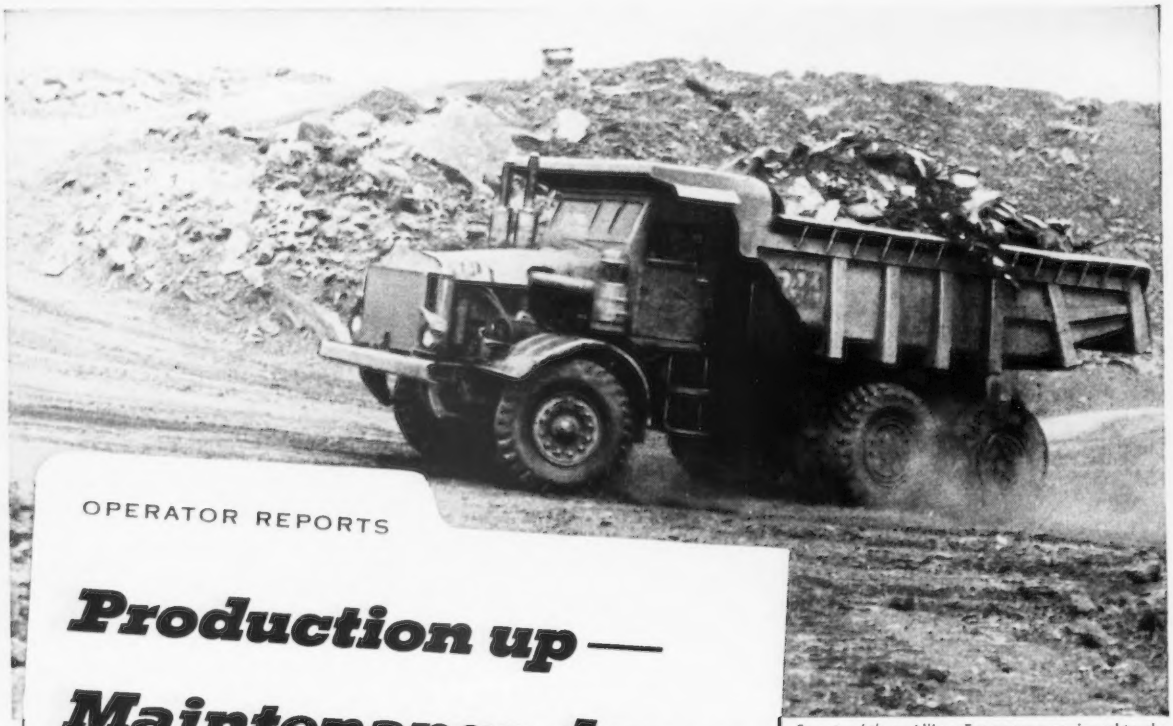
SIMPLEX

in Mine Cable Design . . .

Proved Cables for Every Mine Use!

SERVICE	USE	SIMPLEX PRODUCT
MINING	Electric Drills	TIREX SO Cord, TIREX Heavy Duty Mine Cord.
	Shot Firing	TIREX Shot Fire Cord (Round), Simplex Shot Fire Cord (Twin).
	Shuttle Cars	TIREX Special Shuttle Car Cable (see opposite page).
	Shuttle Cars, Cutters, Loaders, Continuous Miners	TIREX Twin Mining Cable; Type W, without ground wires; Type G, with ground wires. Also TIREX 3-Conductor Round Cable, Type W.
	Locomotives	TIREX Locomotive Cable; steel reinforcing strands in conductor.
	Stripping Shovels and Draglines	TIREX High-Voltage Cables; Types W, G, SH-A, SH-B, SH-C, SH-D.
		All TIREX Cords and Cables are jacketed with CURED-IN-LEAD Selenium-Neoprene Armor. All stock sizes for mine use are marked P-101 BM.
MINE EQUIPMENT	Air Compressors (Portable)	TIREX Twin Cables, Types W and G. TIREX 3-Cond. Round Cable, Type W.
	Air Compressors (Stationary), Ventilating Fans, Mine Pumps, Car Pullers	Anhydrex or Anhydroprene Cables. Both feature the exceptional moisture resistance of Anhydrex insulation and the durability of a neoprene jacket. Anhydrex cables can be installed directly in earth, in conduit and in air. Anhydroprene cables, with lighter jacket, should not be buried directly in earth.
	Track Signal Systems	Anhydrex Multi-Cond. Signal Cable. Polyethylene-Plastex Signal Cable.
	Telephone Systems	Anhydrex Mine Telephone Cable.
PROCESSING EQUIPMENT	Crushers	Anhydrex Cables. Anhydroprene Cables.
	Vibrator Screens	TIREX SO Cords. Anhydrex Cables.
	Flotation Cells	Anhydrex Cables. Anhydroprene Cables.
SHOPS	Machine Tools	TIREX SO and SJO (light service) Cords. Plastex Machine Tool Wire; available with light, heavy and extra-heavy insulation.
	Welding Machines, Electrode Cable	TIREX Super-Flexible Welding Cable.
	Welding Machines, Electrode Return	TIREX Single-Conductor Cable.
	Welding Machines, Power Side	TIREX 2 and 3-Conductor Cables.
	Locomotive Wiring	TIREX Motor Lead Cable.
	Battery Charging	TIREX Twin and TIREX Round Type W Cables.
POWER AND LIGHTING	Aerial Distribution Systems	Anhydrex, Varnished Cambric and Paper Insulated Cables — available with built-in messenger or messenger can be applied in field by spinner.
	Underground Distribution Systems	Anhydrex Cables; provide resistance to water and moisture, soil acids and alkalies; have no metallic sheaths to crystallize and corrode.
	Borehole and Shafts	Anhydrex Cables and Varnished Cambric Cables — available with a wide choice of outer coverings to meet the requirements of all methods of suspension.
	Sub-Surface Distribution	Anhydrex Feeder Cables, Varnished Cambric Feeder Cables.
	Switchboard Wiring	Anhydroprene Wires, Plastex Wires.
	Yard Floodlighting	Anhydrex Cables.

Write for Catalog 1008 — "*Simplex Cables for Mining*"



OPERATOR REPORTS

Production up — Maintenance down

Twenty of these Allison TORQMATIC-equipped trucks are working 21 hours a day hauling 34-ton pay loads of coal and overburden over 7½% grades.

The Wadesville Production Company operates 20 Allison TORQMATIC-equipped Euclid rear-dump trucks hauling 42,000 tons daily in its strip mine near St. Claire, Pa. These trucks boost production by making round trips 25% faster than the mechanical-drive units they replaced.

This operator's records show TORQMATIC DRIVES outlast mechanical drives — maintenance time and costs are down too. At routine overhaul periods, mechanics change out the TORQMATIC DRIVES in 2 hours less time than they change out a mechanical drive.

You, too, can cut your heavy-duty equipment operating costs by specifying Allison TORQMATIC DRIVES the next time you buy. Ask your equipment dealer, manufacturer or write:

ALLISON *Division of* GENERAL MOTORS
Box 894MM, Indianapolis 6, Indiana

ALLISON TORQMATIC DRIVES

Unbeatable Team for Maximum Operating Economy

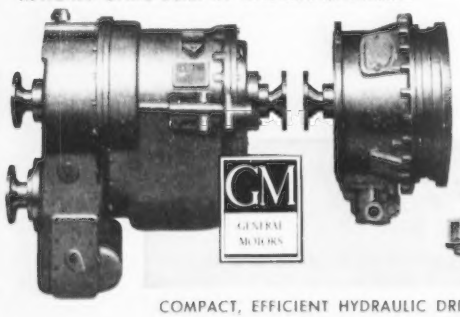
**Quick-shifts* at full throttle with fingertip hydraulic control.

**Holds* power to load at all times — no clutch pedal to push — no gearshift guess.

**Cuts* maintenance cost by absorbing shock — eliminates engine lugging — prolongs equipment life.

**Only* torque converter-transmission team designed to work as a unit and built by one manufacturer.

MATCHED UNITS BUILT BY ONE MANUFACTURER



Allison TORQMATIC DRIVES

COMPACT, EFFICIENT HYDRAULIC DRIVES FOR CRANES * TRUCKS * TRACTORS * SHOVELS * SCRAPERS * DRILLING RIGS

ROCK RATED

to bring your digging up to date

You have the jump on costs when your new P&H takes over the tough digging jobs. Why? Because there's no other machine to match its performance. You have the speed — a 15% to 25% faster digging cycle — for bigger production. You have the all-welded strength to take shock loads that would K.O. less rugged machines. You have the stability to exert more power at the tooth point. That gives you added capacity.

If you're ready to cut your costs, these P&H's are ready to help you.

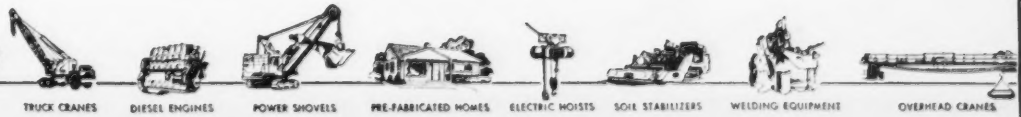
P&H MAGNETORQUE*
ELECTRIC SWING

the greatest shovel improvement in 20 years. It's smoother, faster, more dependable. It eliminates the old swing frictions with their constant headaches and replacement costs. Magnetorque lasts the life of your machine. You should know the facts about it!

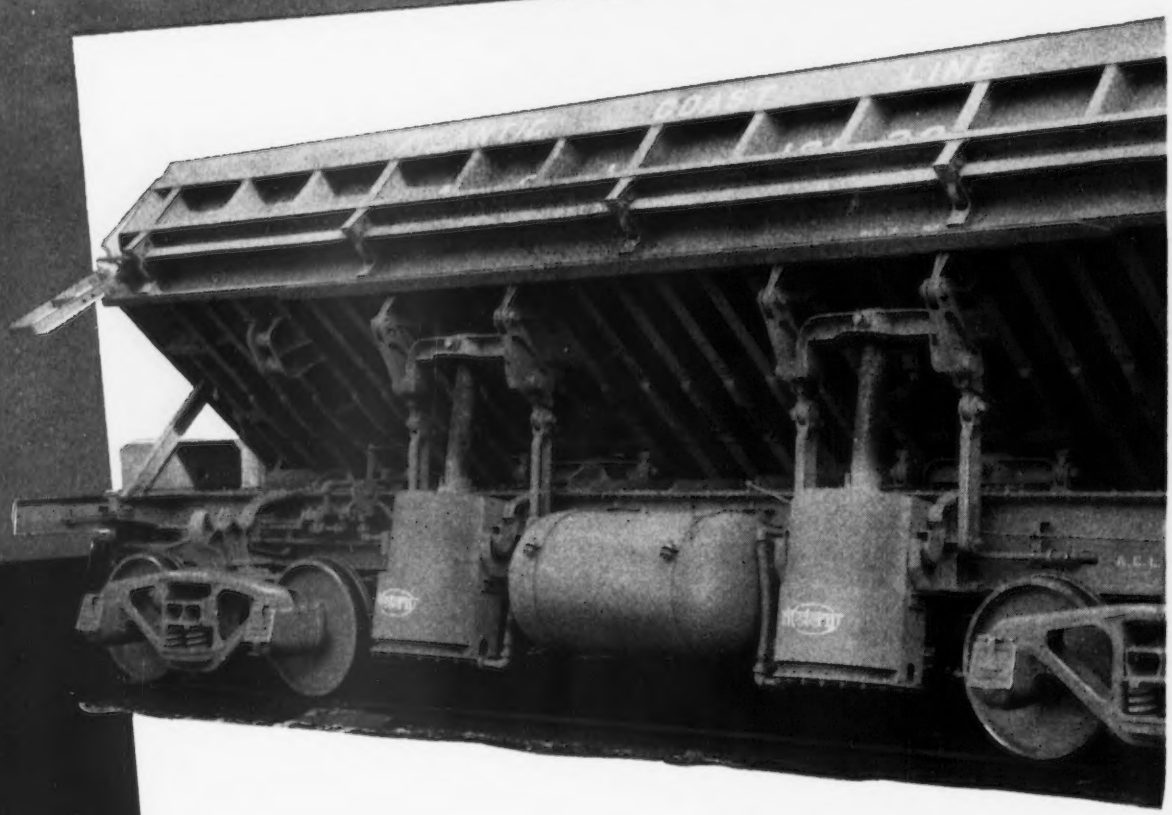
**T.M. of Harnischfeger Corporation for electro-magnetic type coupling.*

P&H LARGE EXCAVATOR DIVISION
HARNISCHFEGER CORPORATION
MILWAUKEE 46, WISCONSIN

the P&H Line



Cut Your Haulage Costs With Modern



Western — Built by the World's Largest Manufacturer

BALDWIN-LIMA

Philadelphia 42, Pa.

Western DUMP CARS

Western dump cars can save you money in several ways:

1. **FASTER AND EASIER** dumping and righting, because of their speedy action and dual side pivots, enable *modern* Westerns to cut operating costs by making those extra trips every day.

2. **EXTRA PAYLOAD** on every trip is the result of Westerns' design and the fact that they are of light but strong alloy steel. Deadweight is reduced to the absolute minimum.

3. **LESS MAINTENANCE, LONGER LIFE** are the inevitable result of their being designed and built so ruggedly . . . bed underframe is welded into a single, strong unit . . . sturdy dumping mechanism is always dependable . . . double plate doors are reinforced for unusual strength where needed most.

In 1952, according to Railway Age Statistics, *nine out of every ten* dump cars bought were *Westerns* . . . thus more and more companies are cutting their haulage costs by replacing obsolete dump cars with *modern* Westerns. For further facts write Dept. 6708, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pennsylvania.

BALDWIN · BLH · LIMA-HAMILTON

of Dump Cars

-HAMILTON

Offices in Principal Cities

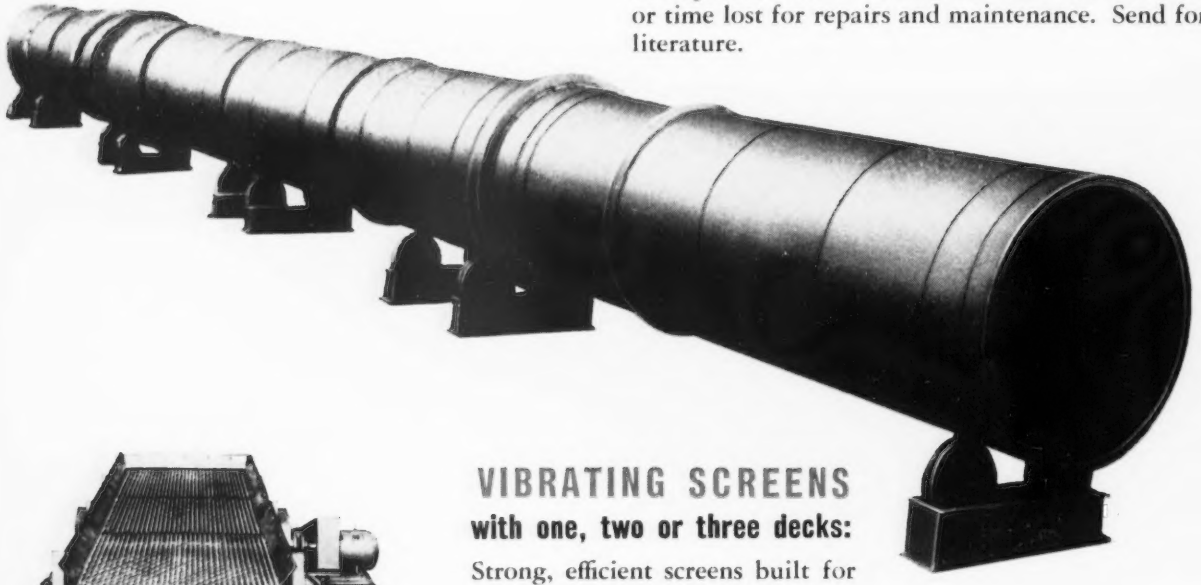
KENNEDY ROTARY KILNS COOLERS AND DRYERS

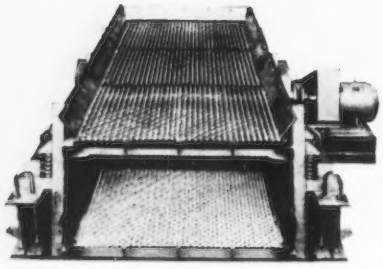
TOP THE FIELD!

. . SECTIONALLY BUILT, ANY LENGTH OR DIAMETER

World-famous for strength, durability and economical operation, Kennedy Kilns combine many exclusive construction details with the latest approved engineering features.

Gear reducers driven by variable speed motors permit rotation of kiln at any desired speed. Riding rings, internally cooled, are mounted on self-aligning bearings for frictionless service. Made in single or multiple units in all lengths and diameters. Noted for uniform production and continuous operation with an absolute minimum of wear or time lost for repairs and maintenance. Send for literature.





VIBRATING SCREENS

with one, two or three decks:

Strong, efficient screens built for heavy duty sifting of a wide range of aggregates. Four-way vibrating motion handles all grades of rock and ore swiftly. Interchangeable mesh readily installed to accommodate any fineness of screening desired. Available in a range of widths and lengths, stationary or portable models.

Send for bulletin!

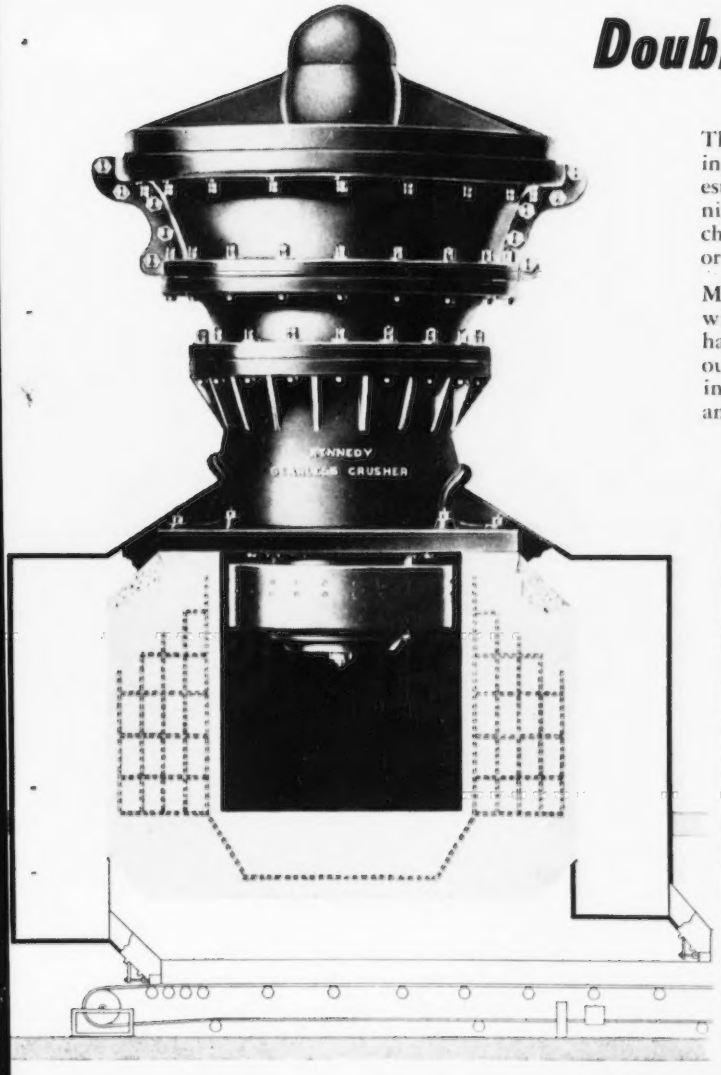
IT COSTS LESS.. TO OWN THE BEST!

KENNEDY - VAN SAUN
MANUFACTURING & ENGINEERING CORPORATION
TWO PARK AVENUE, NEW YORK
FACTORY DANVILLE, PA.

UNMATCHED ECONOMY OF OPERATION...

with KENNEDY

Double Discharge Crushers!

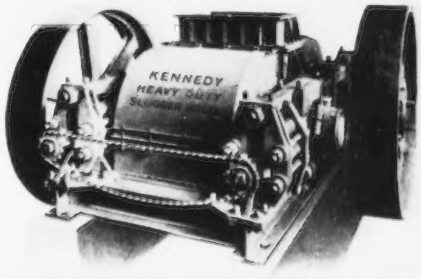


The new Kennedy double discharge crushers afford operating economies not found in any other type. In addition to established and rated power savings through the synchronized motor built directly into pulley assembly, TWO discharge outlets set at 70 degree angle eliminate the sticky ore problem.

Man hours, lost in clearing clogged crushers, is done away with. These new design crushers handle slag, tachonite, hard-to-crush rock and ore with *as much as 50% clay*, without clogging or stalling. For peak capacities at low operating cost, KVS crushers are unmatched! Built in primary and secondary types to suit every crushing requirement.

KENNEDY SLUGGER ROLLS HAVE NO EQUAL FOR FINE PULVERIZING . . . .

Wreck - proof, special purpose roll type Slugger Rolls, built to handle large capacities. Variable reduction from 2" to 10" readily made *while machine is in operation.* Saves time, increases production. Fly-wheel drive. Also made in single, special purpose rolls.



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IT COSTS LESS.. TO OWN THE BEST!

KENNEDY - VAN SAUN

MANUFACTURING & ENGINEERING CORPORATION

TWO PARK AVENUE, NEW YORK

FACTORY DANVILLE, PA.

HERE'S HOW *Burns Brick Co.* increased clay supply from 30 to

New method cuts manpower needs 55%, reduces costs 66%

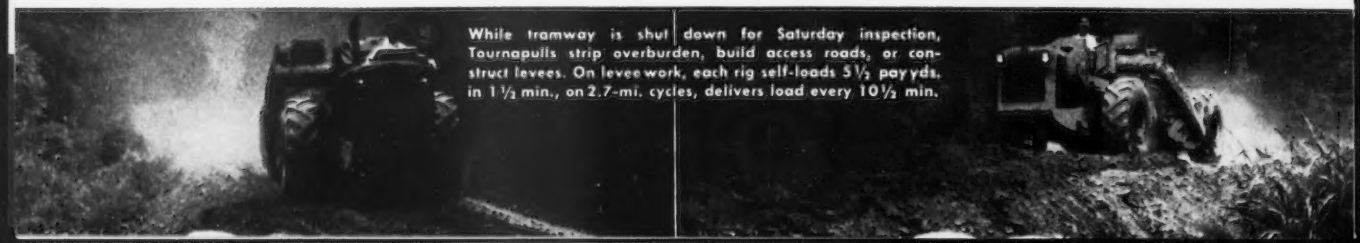
Getting enough alluvial clay to fill ever-increasing production goals has always been a problem for Burns Brick Company, Macon, Georgia. Prior to 1942, material was hauled from pit to plant in shovel-loaded dump trucks. From 1942 to 1950, 4 diesel trains of 4 cars each were used. Production reached 30 tons an hour with this method . . . but, by 1950, demand had exceeded even this supply. More clay was needed . . . fast! The job of boosting output fell to the company's vice president, Henry K. Burns, Jr.

Tournapulls solve feeding problems

Burns had his men build a 3-mile pit-to-plant aerial tramway, running from a hopper and feeder at the clay pits to a 50,000-ton storage shed at the plant. 187 one-ton capacity aluminum buckets spaced 160′ apart and moving 6 m.p.h. were provided to carry the material over the long cable. About 180 tons of clay could be brought in hourly, *if* the hopper could be fed fast enough. First feeding tools tried were 2 crawler-scrapers with 19 yds. combined capacity. Even under the most favorable conditions, these 2 rigs could deliver only 120 tons hourly. Next Burns tried 2 rubber-tired 7-yd. D Tournapulls. They solved the problem! Output was more than enough, and costs were low. After more than a year of operation, major benefits were analyzed as follows:

1. *More production.* Tournapulls have helped boost output 6 *times* over that of dragline and rail cars and 50% over crawler-scrapers — from 30 to 120 to 180 tons per hour. Company production records show the 2 "D's" have averaged 1727 tons per 9½-hour shift . . . or 90.9 tons per hour per machine. At times, the "D's" have supplied enough clay in 20 hours to last the brick production line for a week. In spare time, rigs build access roads and levees on Burns Company property.

2. *Lower costs.* Conversion to the new feeding method has cut costs by two-thirds, according to accurate records kept by the company. Says Mr. Burns: "Our 2 D Roadsters are giving us high production at a very low cost per ton. *Negligible tire wear* (less than ⅛" on drive tires after 9 months of use) and *low fuel consumption* (about 3 gallons per hour per machine . . . or 30 tons of clay per gallon)



While tramway is shut down for Saturday inspection, Tournapulls strip overburden, build access roads, or construct levees. On levee work, each rig self-loads 5½ pay yds. in 1½ min., on 2.7-mi. cycles, delivers load every 10½ min.

Loaded "D's" climb 12% to 15% grade on 100' ramp to tramway hopper. With increased clay supply, the Company now turns out 1,250,000 bricks per week. Ten years is the expected life of this pit before tramway will have to be extended.

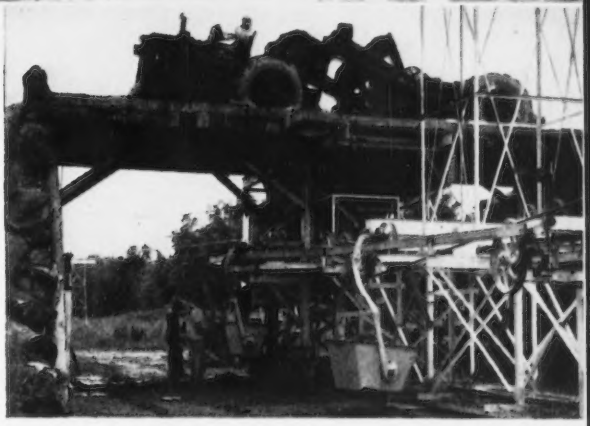
Operator spots rig over hopper, dumps load in a few seconds. Cycles average 2000' . . . combined output, 180 tons of the 3300-lb. material per hour. With over 2400 hours on the 2 Tournapulls, Owner Burns reports "no downtime to date".

180 tons hourly

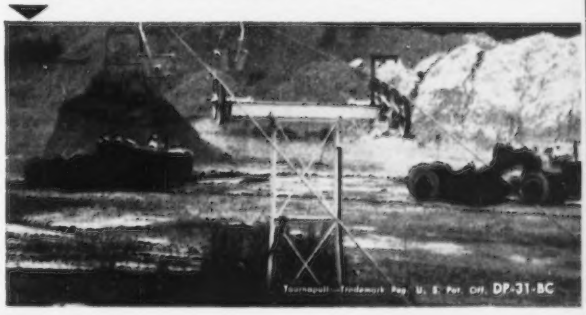
— together with Tournapulls' *efficient electrical system* and their *self-loading ability* — are reflected in the low cost of each ton of clay we move."

3. *Fewer men.* Stripping and hauling with the rail system required a crew of 20 . . . the tramway system requires only 9. Besides the 2 D Roadster operators, 3 men are at loading stations, 2 at clay shed, and 2 at intermediate angle stations. In the near future, the 2 angle station positions may also be eliminated.

4. *Better mixture control.* By making thin cuts of rich clay from one part of pit, and selectively-loading lean clay from another part, Tournapulls automatically blend material in mixture best suited for use at plant. As Burns puts it, "Tournapulls' ability to self-load either slippery wet or hard dry clay enables us to get a more uniform mixture, assuring us a more constant size and a more uniform color in our bricks."



Maintaining 5-to-1 side slope for good drainage, Tournapulls self-load rich and lean alluvial clay in blend best suited for use at factory. Loading in 2nd gear, "D's" make shallow cut over 60' to 300', shaving clay in small pieces for easier handling at plant.

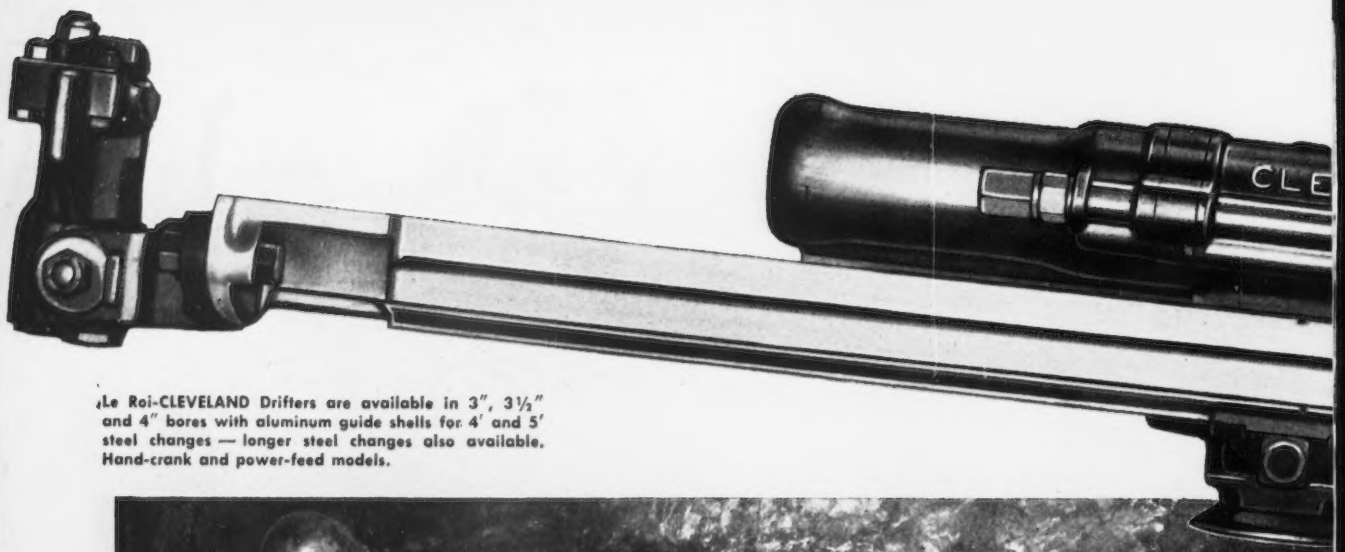


Reduce your costs, speed output

Investigate how much Tournapull can save and earn on *your* dirtmoving. See for yourself . . . ask your LeTourneau-Westinghouse Distributor for data on work like yours.

LeTourneau - Westinghouse Company

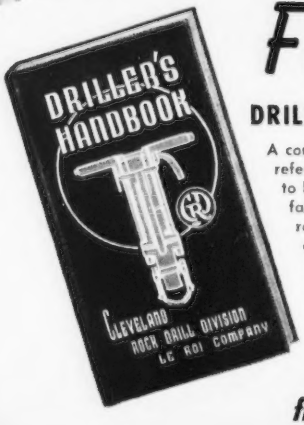
PEORIA, ILLINOIS



Le Roi-CLEVELAND Drifters are available in 3", 3½" and 4" bores with aluminum guide shells for 4' and 5' steel changes — longer steel changes also available. Hand-crank and power-feed models.

Le Roi-CLEVELAND Power Feed Drifters and Jumbo Booms.

Centralizer can be attached to any Le Roi-CLEVELAND Drifter. Directs the steel effectively, when collaring the hole. Easily cleared out of the way, either by hand or by the nose of the drifter, as the machine is fed forward.

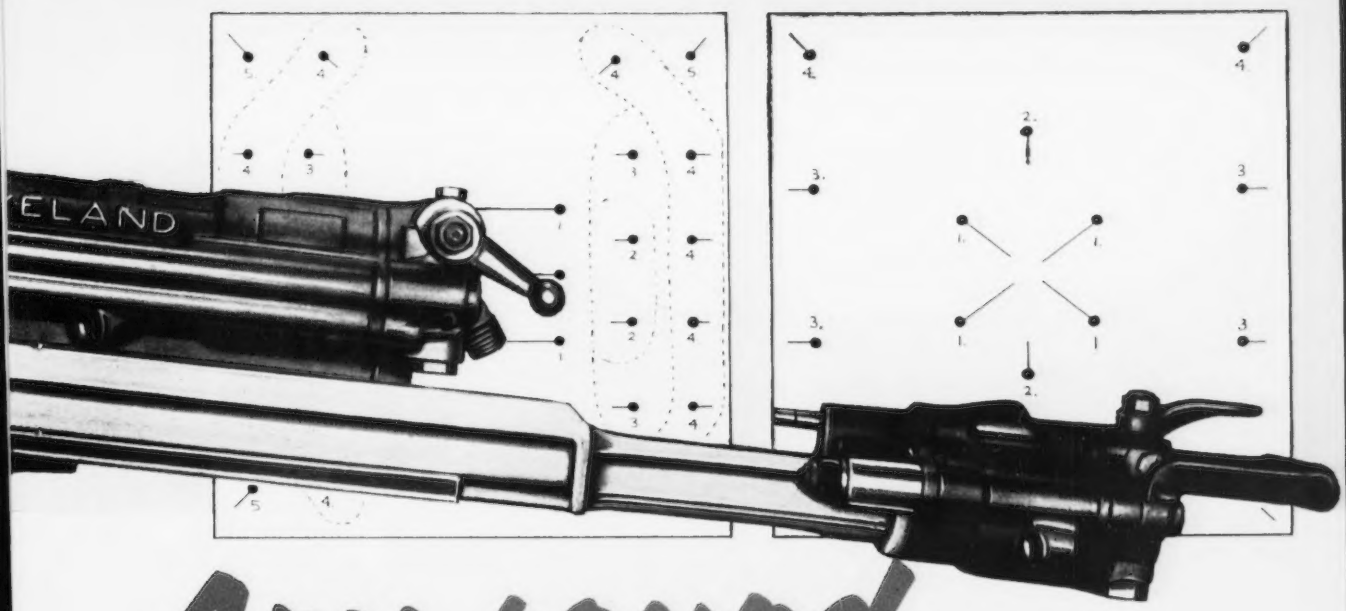


FREE!

DRILLER'S HANDBOOK

A completely revised, pocket-size reference book you won't want to be without. Gives you useful facts it pays to know about rock drills — lubrication, operating, maintenance, shanks and bits, compressed air lines, drilling and blasting, machine mountings, wet drilling, dry drilling, and other information.

Write for your free copy today!



Any round goes faster!

— with Le Roi-CLEVELAND Drifters and aluminum guide shells for 4′ or 5′ steel changes

No matter what pattern they use, your miners drill out the round faster with Le Roi-CLEVELAND Drifters.

It's easy to see why: Le Roi-CLEVELAND Drifters are easier to handle. And they have high drilling speed — plenty of rotation power — a wide selection of steel changes. In short, Le Roi-CLEVELAND Drifters have what it takes to drill more feet of hole per shift.

And — since they help raise your tonnages, they help cut your costs, too. That's because they use air economically — and because they're built "tough" to stay underground where they can do you the most good.

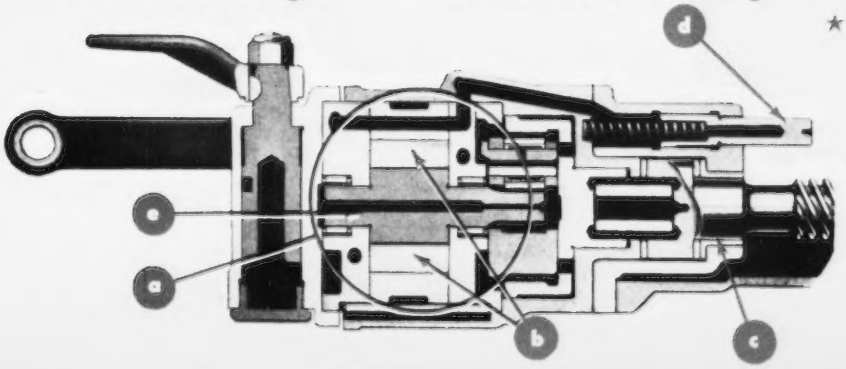
Yes, sir, Le Roi-CLEVELAND Drifters are "just what the doctor ordered," to speed up your drilling cycles, increase your footage, and lower your drilling costs. Ask your Le Roi representative for the whole story.

Write for free Bulletin No. RD25.

CLEVELAND ROCK DRILL DIVISION
Le Roi Company
12500 BEREA ROAD • CLEVELAND 11, OHIO • *Plants: Milwaukee, Cleveland and Greenwich, Ohio*

Advantages of Le Roi-CLEVELAND Power Feed

★ ***Faster steel changes!*** ★ ***Constant rate of drilling!*** ★ ***Reduced operator fatigue!*** ★ ***More footage per shift!***



a. Motor proper is vane-driven, double-lobe type. Power is applied at diametrically opposite points of rotor — for better feeding action, more constant torque.

b. Vane-type design provides fast, positive feeding — uses little air.

c. Floating-joint construction and thrust washers absorb shocks, reduce upkeep.

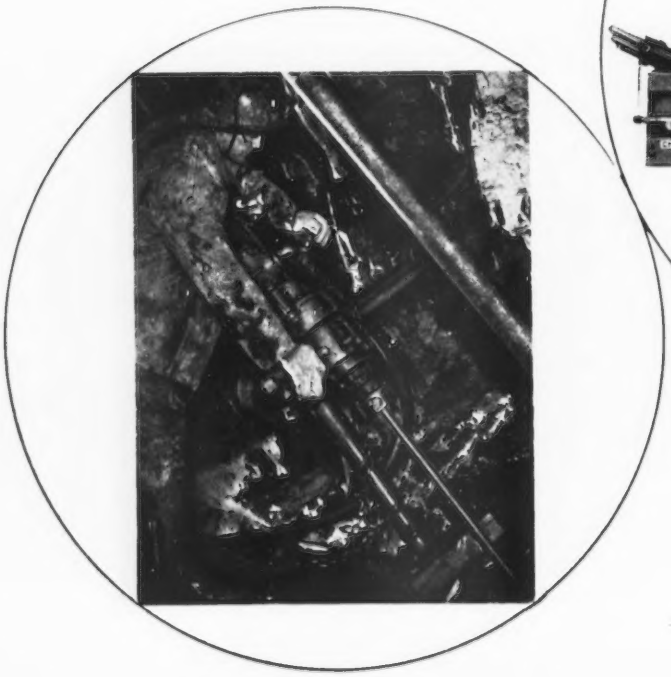
d. Exclusive automatic shut-off valve prevents drifter from hitting feed motor, when changing steels.

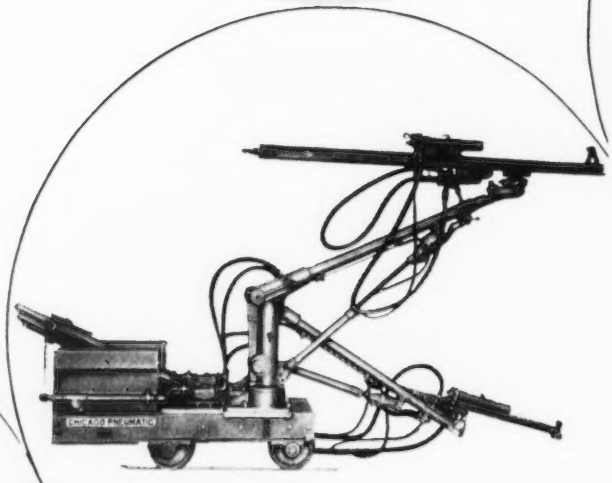
e. One-piece rotor is carried on roller bearings at both ends. The three intermediate gears also operate on roller bearings.

RD-56

IT TAKES ALL KINDS OF DRILLS

For Faster Drilling – Designed both for blast hole and exploratory drilling, the air-driven CP No. 55 DIAMOND CORE DRILL has the most powerful vane-type air motor built into a diamond drill. Conservatively rated at 500 feet with E Rods and EX Fittings.





G-600 DRILL JUMBO with two typical drill mountings. The upper arm is equipped with a 6-foot Chain Type Feed; lower arm carries a 4-foot Shell Type Feed.

For Faster Tunnel Driving – The G-600 AIR ACTUATED DRILL JUMBO is rail mounted for standard track gauges and furnished in single and multi-boom units. Ideal when teamed with the CP-50N DRIFTER.

TO WORK A MINE!

← **For Stoping or Raising** – The well-balanced CP-34 STOPER has just the right piston speed, foot-pound blow, rotating speed and feed-leg pressure to insure long service from tungsten-carbide bits.
Has a ratchet-type twist throttle on the holding handle, for exceptionally fine control of feed-leg pressure.

↑ **For Top Performance** – The complete line of CP SINKER DRILLS ranges from the CP-22 (28-pound) to the CP-50N (102-pound) class. And – the CP-32 or CP-59 combined with the rugged CP AIRLEG mounting make a real team. The AIRLEG provides rigid, well-balanced support to effectively absorb all recoil.

. . . and whether it be for exploratory,
underground or open pit drilling there's a Chicago
Pneumatic drill for every type of mining.

And they all bear the familiar CP Trade Mark
– for 50 years a symbol that has spelled out high
quality and economy to thousands of satisfied customers.

For more details, write *Chicago Pneumatic Tool Company,*
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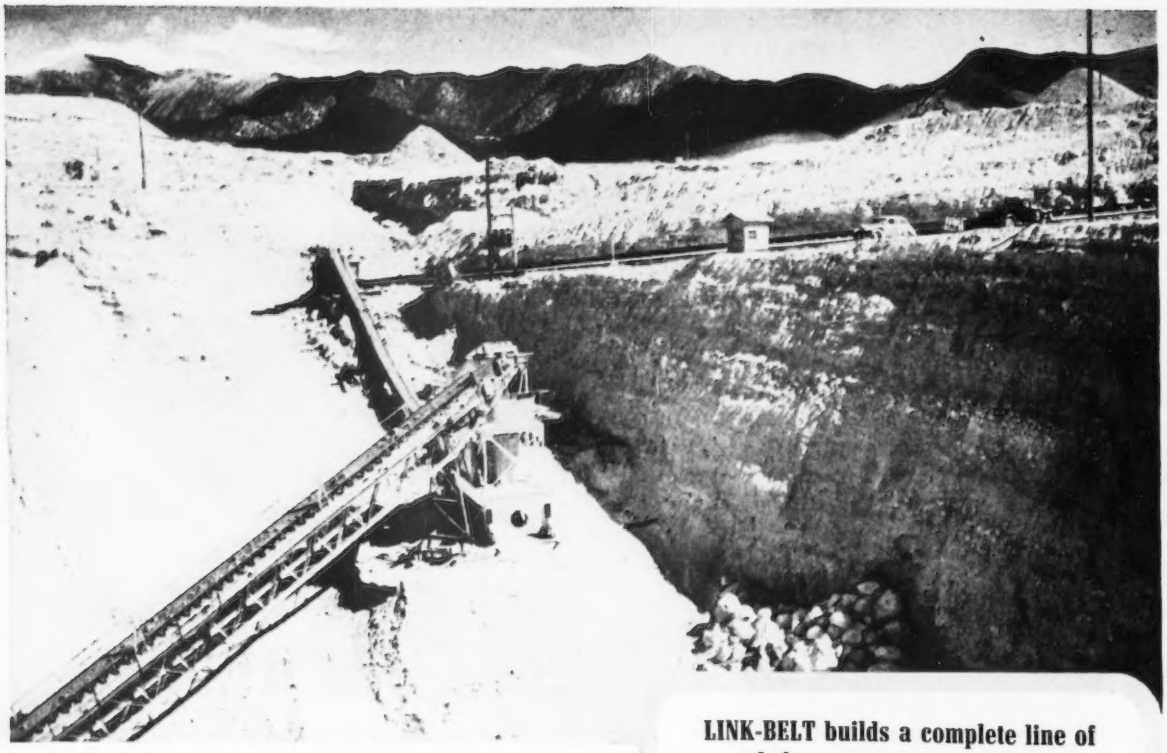
PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

TOTAL ENGINEERING



Porphyry gold ore, crushed enroute, is elevated from pit floor to storage area by series of Link-Belt belt conveyors.

It's your assurance of top efficiency with LINK-BELT belt conveyors

HERE'S how "total engineering" works for you when you use Link-Belt Belt Conveyors. First, Link-Belt conveyor engineers analyze your needs—then recommend the *right* components. In addition, Link-Belt can supply all related equipment — other types of conveyors, feeders, elevators, car dumpers and shakers. And Link-Belt will build your supporting structures and enclosures . . . install the job completely, if desired. Call the Link-Belt office near you for any engineering assistance you need.

LINK-BELT

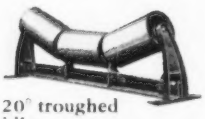
BELT CONVEYOR EQUIPMENT 13.260-D

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales offices in Principal Cities.

LINK-BELT builds a complete line of belt conveyor components

ALL TYPES OF ROLLER BEARING IDLERS

Return idler

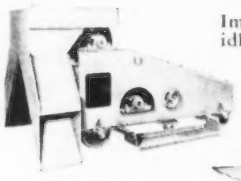


20° troughed idler

Belt-training idler

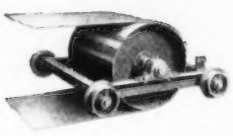
Rubber tread return idler

Impact-cushioning idler



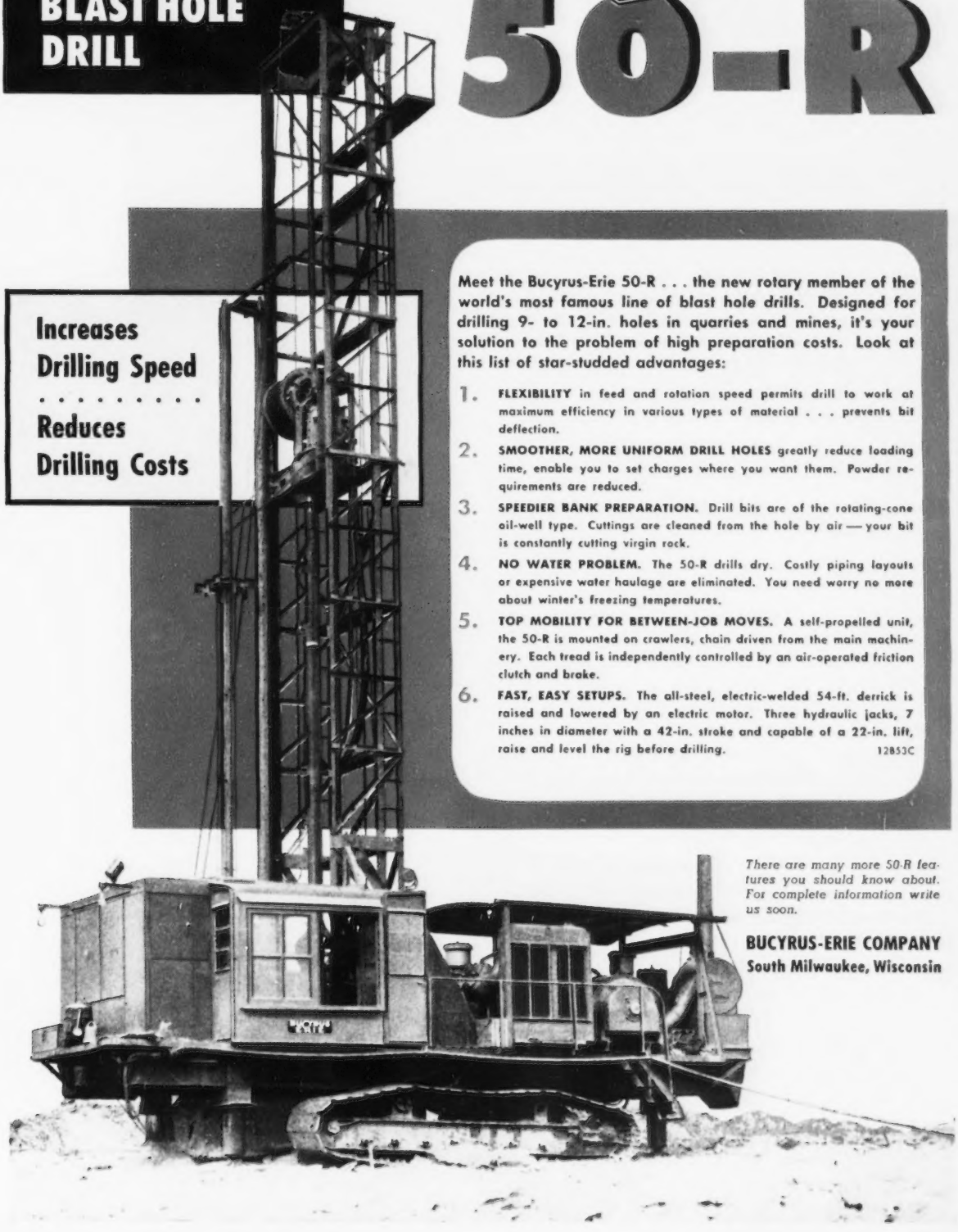
BELT AND MOTOR PROPELLED TRIPPERS

COMPLETE TERMINAL MACHINERY



NEW ROTARY BLAST HOLE DRILL

The BUCYRUS ERIE 50-R



Increases Drilling Speed

. . . . . .

Reduces Drilling Costs

Meet the Bucyrus-Erie 50-R . . . the new rotary member of the world's most famous line of blast hole drills. Designed for drilling 9- to 12-in. holes in quarries and mines, it's your solution to the problem of high preparation costs. Look at this list of star-studded advantages:

1. **FLEXIBILITY** in feed and rotation speed permits drill to work at maximum efficiency in various types of material . . . prevents bit deflection.
2. **SMOOTHER, MORE UNIFORM DRILL HOLES** greatly reduce loading time, enable you to set charges where you want them. Powder requirements are reduced.
3. **SPEEDIER BANK PREPARATION.** Drill bits are of the rotating-cone oil-well type. Cuttings are cleaned from the hole by air — your bit is constantly cutting virgin rock.
4. **NO WATER PROBLEM.** The 50-R drills dry. Costly piping layouts or expensive water haulage are eliminated. You need worry no more about winter's freezing temperatures.
5. **TOP MOBILITY FOR BETWEEN-JOB MOVES.** A self-propelled unit, the 50-R is mounted on crawlers, chain driven from the main machinery. Each tread is independently controlled by an air-operated friction clutch and brake.
6. **FAST, EASY SETUPS.** The all-steel, electric-welded 54-ft. derrick is raised and lowered by an electric motor. Three hydraulic jacks, 7 inches in diameter with a 42-in. stroke and capable of a 22-in. lift, raise and level the rig before drilling.

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There are many more 50-R features you should know about. For complete information write us soon.

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As America's great *copper* industry grew in stature through the years—the nation's *refractories* industry kept pace in providing quality products in dependable supply—scientific research to meet every problem. General Refractories Company is proud to have been able to contribute.

GREFCO K, formerly REFEX CB, and GREFCO M, formerly Grefco's burned magnesite brick, are leading favorites. In addition, there is GREFCO C, which was previously known as Grefco burned chrome brick, and PEREFEX, Grefco's high magnesia-low iron burned magnesite brick.

REFEX, Grefco's famous *unburned* basic brick, pioneered in the industry . . . has won *wide* acceptance in smelting and refining furnaces, above and below metal lines, and actually made possible today's suspended roofs.

STEELKLAD, Grefco's patented unburned basic brick, permanently jacketed in a steel casing, is fast becoming popular where maximum spalling resistance is required in roofs and walls above the metal lines in smelting and refining furnaces.

Grefco is also proud to furnish industry with the *finest* of SILICA, FIRECLAY, HIGH ALUMINA and BASIC brick, together with a long line of superior specialties. Truly, you can depend on Grefco for *a complete refractories service*. Call on us!

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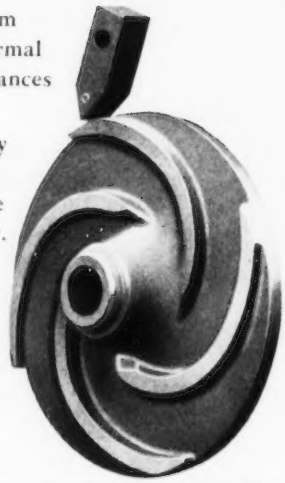
With Rex and only Rex

You're assured new pump efficiency for the lifetime of the pump because...

ONLY REX HAS THE ADJUSTABLE AIR PEELER!

Every self-priming, centrifugal pump must have an air peeler to remove air from the suction line and create the vacuum that draws water up to the impeller. Normal wear on the peeler and fast-moving impeller destroys the necessary close clearances between these parts . . . reducing both priming and pumping efficiency.

Here's where *Rex alone* can maintain original priming and pumping efficiency for life. A simple adjustment of the *exclusive Patented Adjustable Air Peeler* and you've restored its original close clearance with the impeller. Just a twist of the wrist and you've restored new pump efficiency . . . for today . . . and tomorrow.



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Setting the Pace For TACONITE PROCESSING

ALLIS-CHALMERS Grinding Mills

Allis-Chalmers know-how and equipment have been playing a leading role in the processing of taconite. A-C research laboratory tests, along with pilot plant operations and field work, have revealed valuable data on the processing of low grade iron ore. Crushers, vibrating screens and grinding mills furnished by Allis-Chalmers are already helping to solve the problem of taconite processing on the Mesabi range.

This *unsurpassed* background and experience on taconite, as well as A-C's many years of successful accomplishments on other ores, is available to you when you call an Allis-Chalmers representative. Phone the A-C man nearest you today, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

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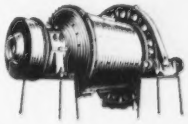
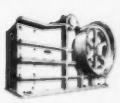


Grinding Mills

Sales Offices in Principal Cities in the U. S. A. Distributors Throughout the World.

Vibrating Screens



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Proof that mining men find it profitable to specify Allis-Chalmers grinding mills is seen in the fact that *7 out of 10* A-C mills sold today are repeat orders!

Correct Eastern Standard Time is June 21st 1630 B.C.

From before the dawn of recorded history, man has tried to penetrate the mysteries of time and to measure its flight. At Stonehenge, on Salisbury Plain, England, sun-worshipping Druids set up, 35 centuries ago, what may have been a colossal shadow clock which marked, at least, the semi-annual swing of the sun. When the priest at the altar stone saw the sun rise directly behind the Hele Stone, he knew that the day was June 21st, or, rather, he knew that on this day the sun would cease to swing northward and would, on the morrow, start its retreat to the south. Other stones similarly marked the winter solstice, six months later. This solidly built timepiece is still running just as accurately as it did in the Bronze Age, but its six-month divisions of time are somewhat too broad for today's requirements, when time is so valuable. In the drilling business, Truco Diamond Bits have proved to be great time-savers. Their irresistible cutting power takes them through any formation swiftly, accurately, thriftily, dependably. They are used profitably in every phase of drilling. Have you our Diamond Bit Catalog?

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Makes Cyclone Performance Better than Ever for Desliming and Classifying

Heyl & Patterson Cyclone Thickener Equipment . . . well known and accepted for efficient, low-cost thickening, classifying, clarifying and desliming . . . now has expanded limits of performance, with the new Heyl & Patterson "Jet-Injection" Cyclone.

In "Jet-Injection" operations, water is forced into the Cyclone at a definite rate and under controlled pressure. This results in a sharper and a more accurate classification of the slurry provided the installation is properly engineered and "Jet-Injection" correctly applied.

During desliming or classifying operations, objectionable slimes that formerly reported to the underflow of the Cyclone with the "wanted" materials can now be removed in the overflow with "Jet-Injection."

HOW YOU BENEFIT FROM THE HEYL & PATTERSON CYCLONE RESEARCH PROGRAM

Heyl & Patterson Research Engineers have conducted numerous laboratory and field experiments to determine the various applications of Cyclones on both ferrous and nonferrous milling circuits. Typical Cyclone applications are: desliming ahead of froth cells; classification for preparation of classified feeds; and in closed circuits with ball mills.

It will pay you to call on the vast experience and know-how of Heyl & Patterson to help you with your desliming or classifying problem. Heyl & Patterson's complete laboratory facilities are available to test the performance of the "Jet-Injection" Cyclone on your product.

EXAMPLE OF "JET-INJECTION" PERFORMANCE

PROBLEM: Classify a slurry having 10% solids concentration by weight containing 30% minus 200 mesh (minus 74 microns) material with a Heyl & Patterson Cyclone.

RESULTS WITHOUT "JET-INJECTION": Recovered product contained 8% minus 200 mesh material.

RESULTS WITH "JET-INJECTION": Recovered product contained 4% minus 200 mesh material.

For more information on "Jet-Injection", write for Booklet CT-31.

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Thorsten Coal Sampling Systems
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Left: Standard Coring Bit, for best results in hard, firm, rock.
Center: Impregnated Coring Bit, for best results in broken or extremely abrasive rock.
Right: Series "M" Coring Bit, for maximum core recovery from coal or fragile rock.

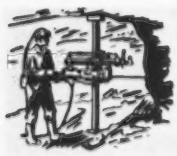
for Faster Drilling and Better Cores at Lowest Cost Per Foot

TAILOR-MADE DIAMOND BITS

To secure best-possible all-round results in diamond core drilling, the bits used must embody the correct combination of design, matrix, size and grade of diamonds, for the particular type of formation encountered. The wide variety of standardized combinations illustrated and described in our new Bit Bulletin enables purchasers to make a satisfactory selection in most cases, but we welcome opportunities to develop special bits to meet unusual conditions or requirements. Write for Bulletin 320 and tell us about your operating conditions.

HIGH-SPEED DRILLING MACHINES

Our wide line of high-speed diamond drilling machines meets every requirement for both core drilling and blast-hole drilling at minimum expense—measured by the results achieved. Modern design, rugged construction, anti-friction bearings and heat-treated alloy-steel wearing parts permit long periods of continuous high-speed operation under the most difficult conditions. Illustrated bulletins, containing complete specifications and working data, mailed on request.



COMPLETE ACCESSORY EQUIPMENT

To meet the requirements of our own contract drilling crews, we are obliged to supply a wide variety of accessory equipment and to carry all commonly-used items in stock for immediate delivery. The same prompt service is available to other diamond drill operators and ordering is made easy by a 28-page catalog which gives all necessary information—including illustrations, piece numbers, weights and code numbers, for ordering by wire or cable. Every operator of a diamond drilling rig should have a copy of Bulletin 31-F and we'll send one free of charge.

WORLD-WIDE CONTRACT DRILLING

For more than sixty years, Sprague & Henwood, Inc. has been a leader in the field of diamond core drilling by contract. During this long period, our crews have completed thousands of contracts successfully, in practically every corner of the globe. Besides exploratory drilling for coal and ore, our service includes foundation-test drilling, grout holes and pressure grouting. Correspondence is invited regarding any diamond drilling job—anywhere. Estimates on request.

SPRAGUE & HENWOOD, INC.

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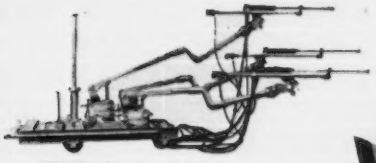
cut corners from time schedules and cost estimates with...

DEEP HOLE DRILL—The NEW SFH99—with Gardner-Denver Sectional Rods—permits a 4' change when ring drilling from a 7' drift.

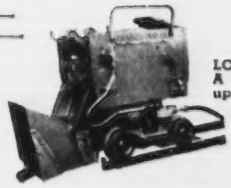
STOPER—Balanced to boost production.

SINKER—Drives sinking costs to bed-rock.

DRIFTER—A fast driller—with a long feed.



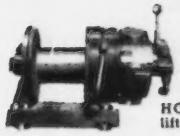
JUMBO—For a quick set up and get out.



LOADER—A quick pick-up for profits.

PORTABLE COMPRESSOR—Moves air right in—anywhere.

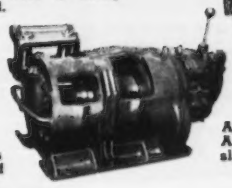
STATIONARY COMPRESSOR—Cuts air costs at the source.



HOIST—Gives a lift to productivity.

SHARPENER—If you figure steel forming costs with a sharp pencil.

LINE OILER—Automatically saves wear on rock drills.



AIRSLUSHER—A steady tug cuts slushing costs.

SUMP PUMP—Sucks nuisance water out of the way.

GARDNER-DENVER MINING EQUIPMENT

Send for descriptive Bulletins.

SINCE 1859

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Gardner-Denver Company, Quincy, Illinois
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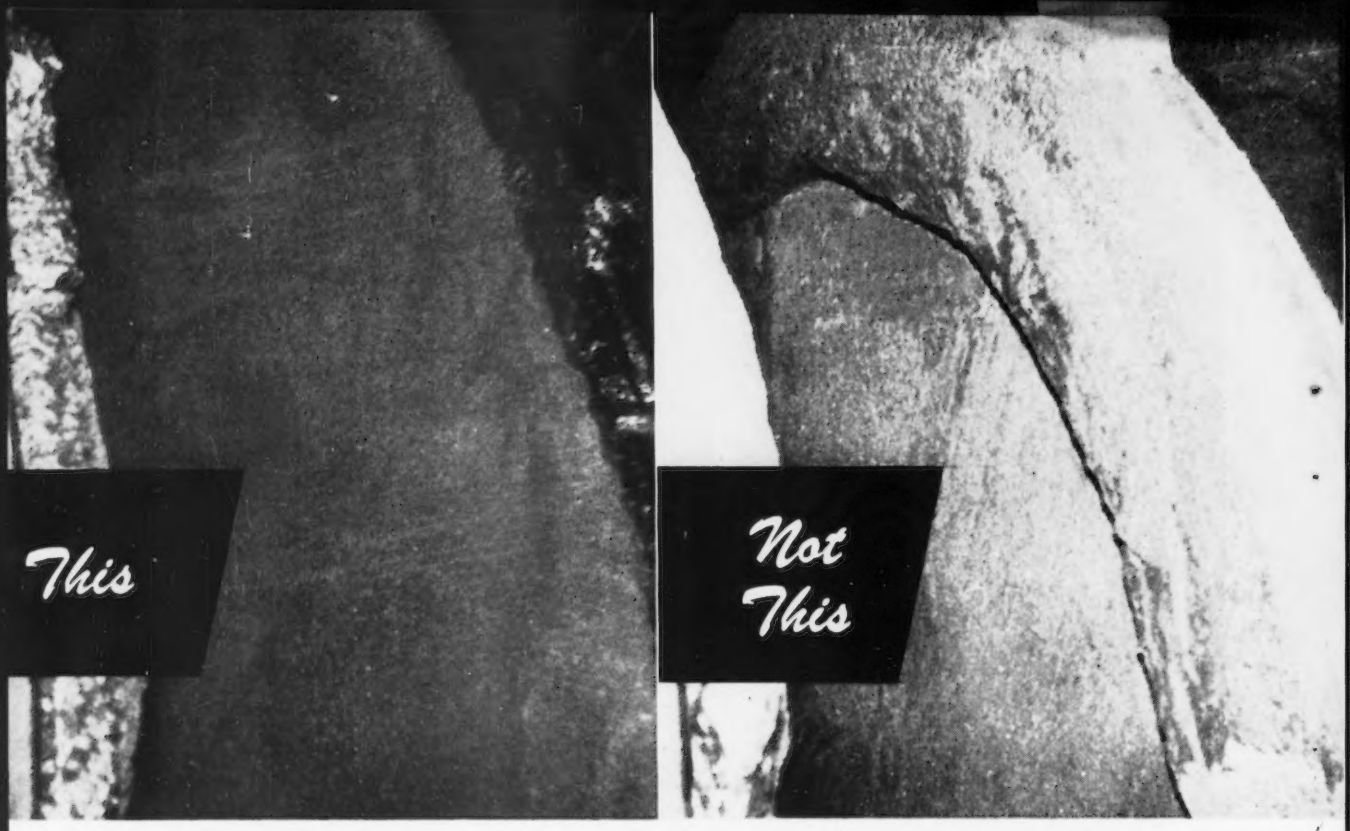
THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY



ELIMINATE "CLASSIFICATION RING"

The "Classification Ring" or heavy solids deposited on the periphery of the disc is caused by pick up at the bottom of the tank of the greater concentration of heavy solids settling in that area.

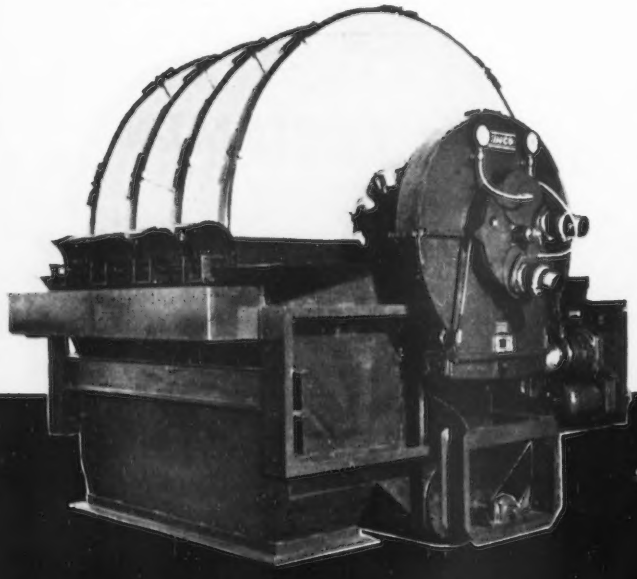
This cake formation can be eliminated and evenly distributed cake over the entire surface of the sector for better drying, greater tonnage and longer bag life.

Numerous tests have proved that the use of Eimco Agidisc filters in metallurgical slurries has reduced moisture content of cake and increased production and filter bag life.

The illustrations above show two filters operating simultaneously side by side in the same plant, on the same feed. The filter on the left shows smooth, evenly distributed cake as a result of Eimco engineered Agidisc construction fitting a special application to a special job. The filter on the right is an ordinary disc filter.

Results in this plant showed 1½% less moisture content and 20% more tonnage on the Eimco Agidisc filter.

Write for more information on Agidisc filters for metallurgical slurries.



The Eimco Agidisc Filter Custom Designed for Slurries with Fast Settling Solids

You Can't Beat an Eimco

EIMCO

A464

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The World's Leading Manufacturer of Vacuum Filtration Equipment

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No. D3A500RM Male
& No. D3A500RF Female
Plugs Illustrated

for peak production
SECTIONALIZED CABLE WITH JOY (SPB) PLUGS

BULLETIN
No. B39a

Modern mining schedules allow little time for cable repair or replacement. That's the reason why more and more portable power feeders are being *sectionalized* with JOY SPB (Straight Pin Bigun) Connectors. Cable so sectionalized can be quickly lengthened or shortened through addition or deletion of sections . . . and damaged sections can be easily replaced. This cuts "down-time" to a minimum and increases production.

JOY Straight Pin Bigun Connectors are built for rough mining service. Equipped with threaded couplings and the famous JOY two-way water seal, they can't be surpassed for performance, safety and durability . . . and because they're molded to cable as one-piece neoprene units, they're shatter-proof, wear-resistant and highly impervious to the deteriorating effects of moisture, grease or oil.

JOY SPB plugs are available for A.C. or D.C. operation in a wide variety of conductor combinations and current capacities. • For more detailed information, ask for your copy of Bulletin B39 A. You'll be glad you did! ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.,*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Consult a Joy Engineer

JOY

WORLD'S LARGEST MANUFACTURER OF UNDERGROUND MINING EQUIPMENT

W&D M 4539

Use G-E GEOPRENE PORTABLE CABLE for the really tough jobs!

Built for the really tough jobs, G-E Geoprene portable cable is unsurpassed for use with shovels, draglines, loaders, and other heavy portable equipment.

Its abrasion-resistant neoprene-base jacket is resistant to most oils, acids, alkalies, sunlight, and flame. For additional strength, a tough, corded reinforcing mesh increases the cable's ability to withstand continual hauling and dragging, while the conductors themselves are rope-stranded for maximum flexibility.

In the full line of General Electric wires and cables you will find exactly the cable you need. This famous line includes G-E No. 1799 varnished-cambric-insulated cable, Super Coronol* cable, wire armored cable for borehole service, interlocked armor cable, aerial cable, mine telephone cable, Flamenol* control cable, and magnet wire.

**Registered Trade-mark General Electric Company*

You can put your confidence in—

1879 75 1953 YEARS OF ELECTRICAL PROGRESS

GENERAL ELECTRIC

WIRE AND CABLE IDEAS for Metal Mining

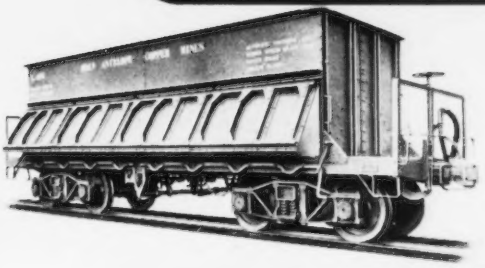
G-E Super Coronol preassembled aerial cable has many advantages over ordinary power cable. No field assembly is necessary . . . insulated conductors, binding strip, and messenger are completely assembled at the factory. Cable requires minimum clearance of right-of-way and can be quickly installed. Maintenance cost is low.

For the winding of motors, lifting-magnets, brake-coils, generators and starters, General Electric offers two types of magnet wire. For temperatures to 105 C, specify Formex*, Class A, an exceedingly flexible, tough, abrasion-resistant wire. Specify Deltabeston*, Class B, insulated with glass or asbestos, for temperatures to 125 C; Class H, with silicone-varnish impregnation, for temperatures to 180 C.

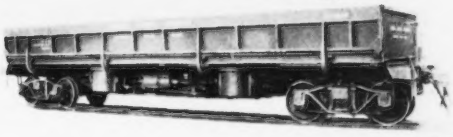
G-E shot firing cord is reliable and economical. Sturdy, flexible, highly resistant to moisture and mechanical injury, it has a *red* rubber jacket for easy identification.

The wide line of G-E wires and cables for the Mining Industry is described, with valuable application data, in this 24-page illustrated booklet. For your copy write to Section W71-795, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

SKILL, KNOWLEDGE, and WORLD-WIDE EXPERIENCE Solve Your Transportation Problems and Needs

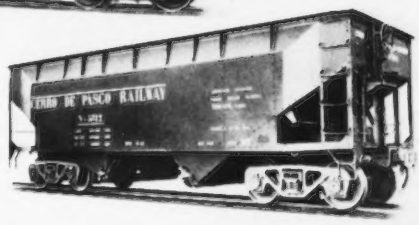


Manufacture of Railway Cars for Export Our Specialty.

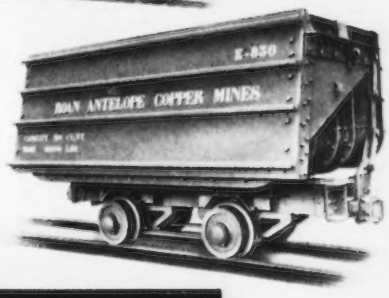


HIGHEST QUALITY
RUGGED CONSTRUCTION

MODERN DESIGN
PROMPT DELIVERY



We design and build cars to meet customer's particular requirements, or to suit standard railway specifications of countries served.



GREGG

THE GREGG COMPANY, LTD., 19 Rector St., New York 6, N. Y.
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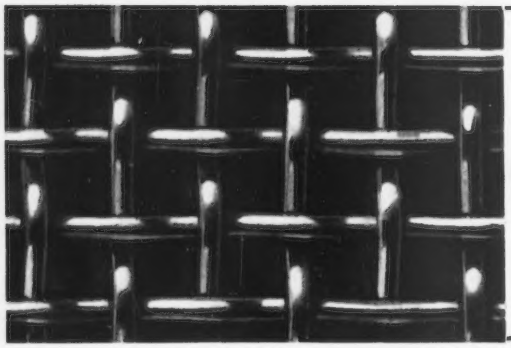
CF&I STEEL PRODUCTS for

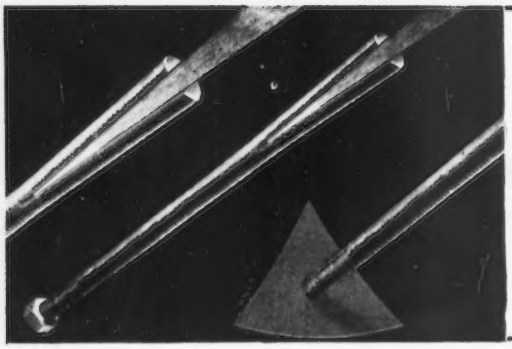
WICKWIRE ROPE

Over 125 years of experience in the manufacture of wire and wire products stands behind Wickwire Rope. It is made from wire with the maximum degree of hardness, strength, toughness and fatigue resistance. Quality controls, through the manufacturing process, assure the utmost in performance, safety and long life.



CAL-WIC INDUSTRIAL SCREENS

For every screening operation there is a Cal-Wic Screen that will give maximum output of the desired product with minimum wear. They are woven to the most exacting tolerances for the greatest efficiency.

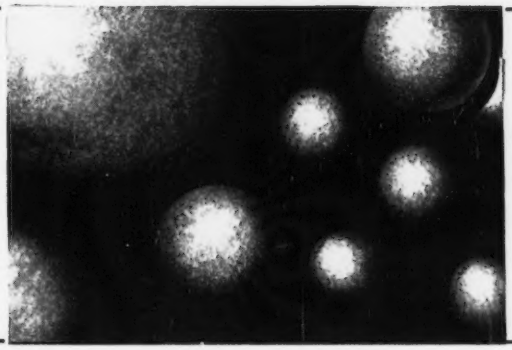


CF&I ROCK BOLTS

This modern means of mine roof or wall support provides greater safety, economy and better housekeeping. Slot and wedge type, as illustrated, or expansion shell type.

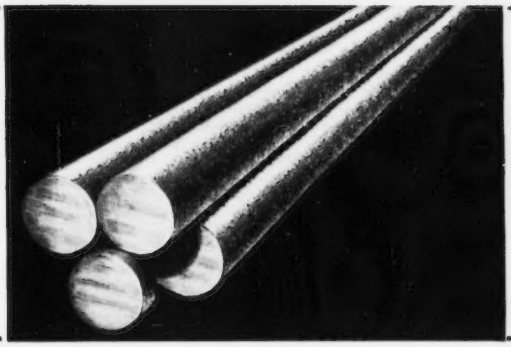
From ore to finished product . . . CF&I mining specialties are products of a completely integrated operation. They are manufactured to the high standards of quality recognized by the mining industry.

MINING'S GREATEST ERA



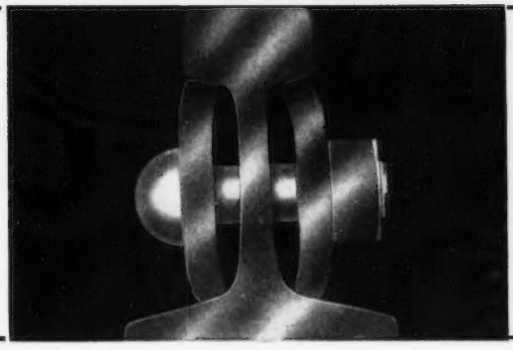
CF&I GRINDING BALLS

CF&I Grinding Balls are forged from special analysis steel to give high impact and abrasion resistance . . . the balance between toughness and hardness insures greater through-put, even wear and high efficiency.



CF&I GRINDING RODS

Rolled from special analysis steel for efficient, economical grinding. Machine straightened with square cut ends. Equally effective for Fine Crushing or Coarse Grinding.



CF&I MINE RAILS & ACCESSORIES

Made to A.R.A. standards; available in a range from 12 to 45 pounds. Accessories include splice bars, angle bars, spikes, track bolts and nuts—square or hexagon.

1758

THE COLORADO FUEL AND IRON CORPORATION • Denver, Colorado

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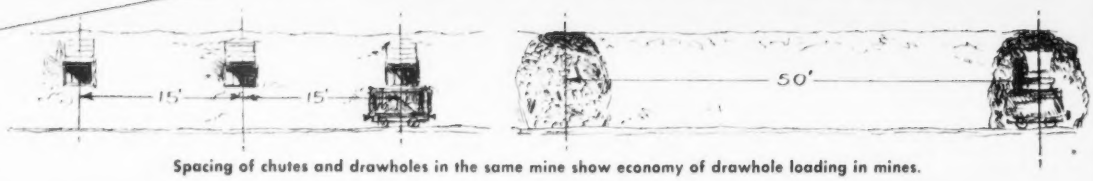
LOWER COST BY LOADING MECHANICALLY



Spacing of chutes and drawholes in the same mine show economy of drawhole loading in mines.

Loading from draw points with mechanical loaders is being used more and more in the development of ore bodies because it has so many advantages. It's cheaper, faster and safer than the chute and grizzly system.

One of the most important differences is the elimination of the grizzly level entirely and the wider spacing of draw points without sacrifice in control of drawing the ore.

Bulletin L1017 shows cost figures on several different operations where chute and grizzly system have been changed over to draw point loading with Eimco loaders. Your copy will be sent on request.

EIMCO A459

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

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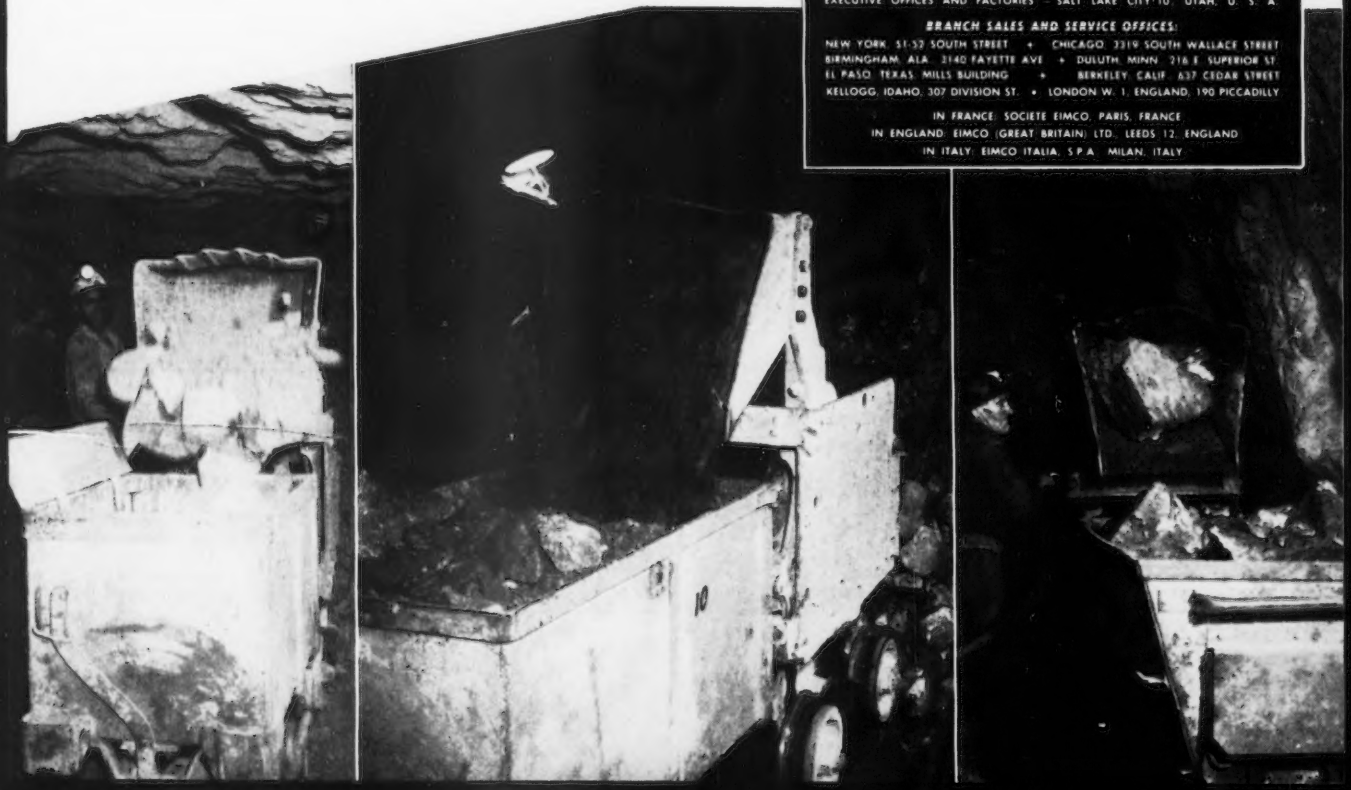
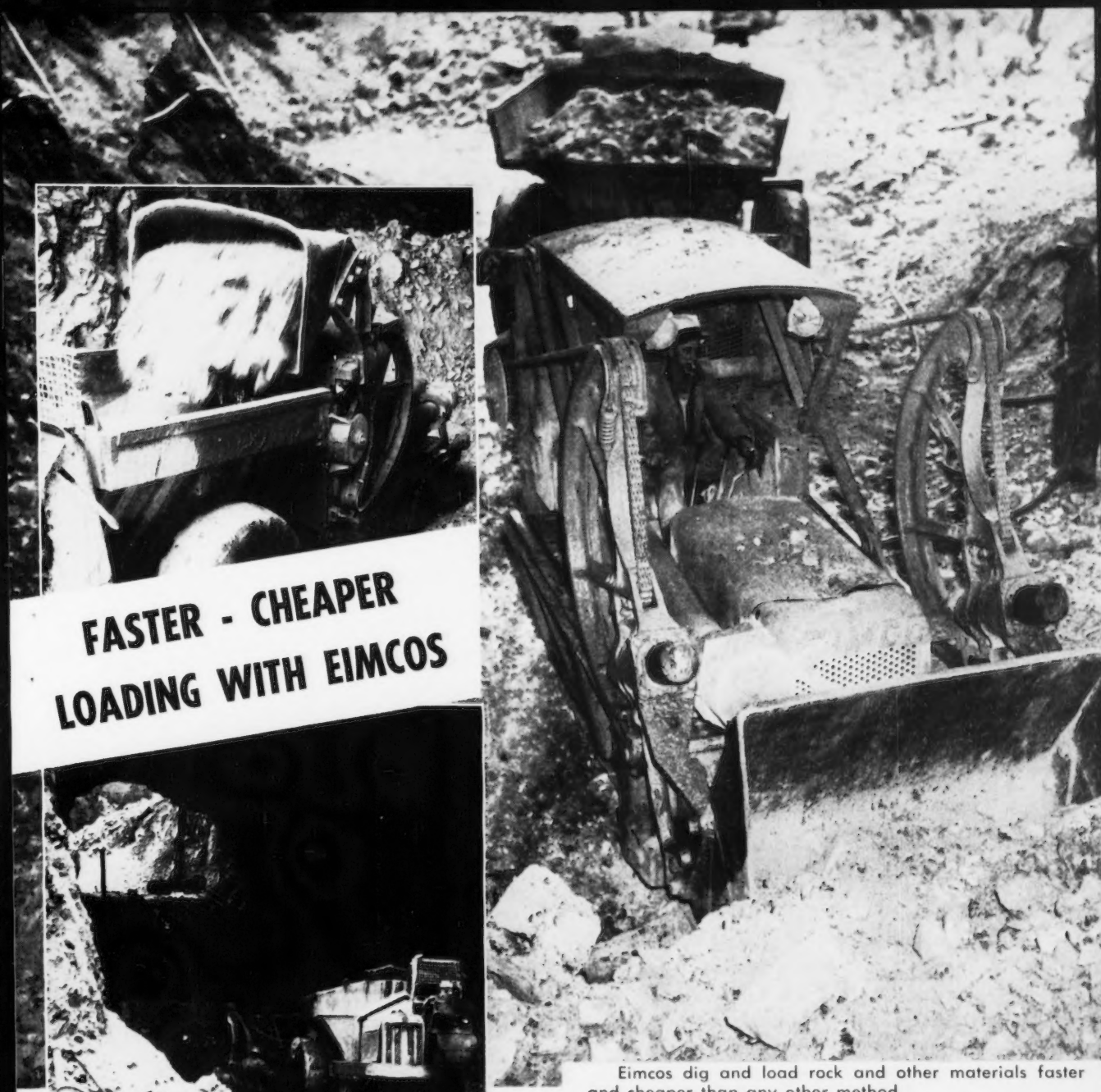
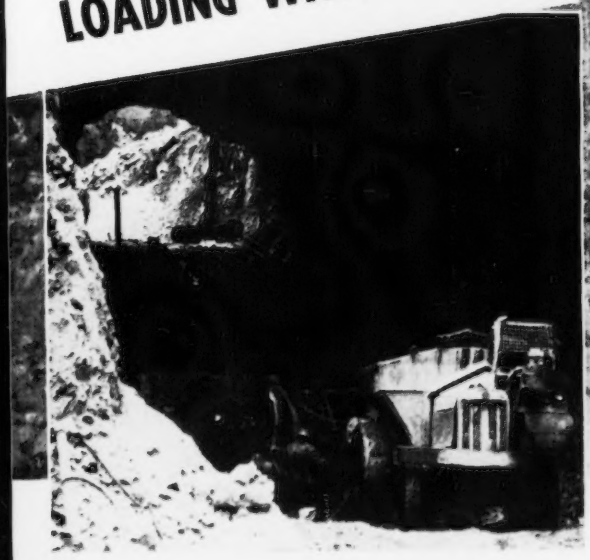




FASTER - CHEAPER LOADING WITH EIMCOS



Eimcos dig and load rock and other materials faster and cheaper than any other method.

In the illustrations above a short division tunnel is being driven on the bench method with one Eimco 104 tractor loader doing all the loading. This has been a good job for the contractor because of the low cost loading performance of his Eimco loader.

For rugged dependability in loading equipment on any size job see your Eimco representative first.

Write for literature on Eimco loaders.

You can't beat an Eimco

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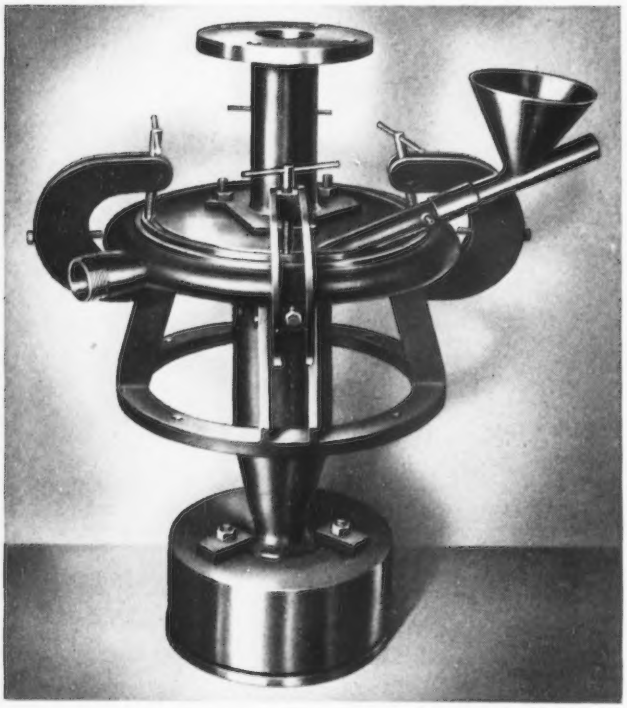
Announcing the STURTEVANT

MICRONIZER*



Pulverizing Machine for Reducing Materials to Micron Sizes

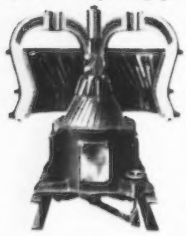
A fluid jet pulverizing machine, the Sturtevant *Micronizer* speeds reduction of materials to low micron sizes. These jet mills are especially applicable in fields where a particle size in microns is desired.

Sturtevant *Micronizer* mills are used throughout industry for reducing non-metallic and metallic minerals and ores, pigments, insecticides, fungicides, pharmaceuticals, plastics, dyes, and numerous other organic and inorganic products.

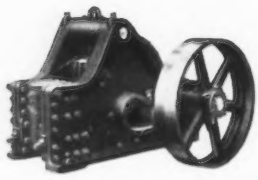
Sturtevant *Micronizer* pulverizers are available in many sizes and capacities. Write for information.

Other Sturtevant Pulverizing Equipment for Rapid Reduction of Materials...

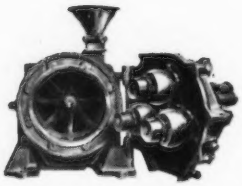
Especially Applicable for Initial Grinding of Products for the Micronizer Mill



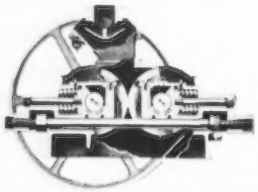
ROTARY FINE CRUSHERS for intermediate and fine reduction (down to ¼"). Open door accessibility. Soft or moderately hard materials. Efficient granulators. Excellent preliminary Crushers preceding Pulverizers.



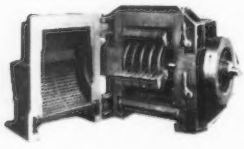
JAW CRUSHERS for coarse, intermediate and fine reduction of hard or soft substances. Heavy or light duty. Cam and Roller action. Special crushers for Ferro-alloys. Several types, many sizes.



RING-ROLL MILLS for medium and fine reduction (10 to 200 mesh), hard or soft materials. Very durable, small power. Operated in closed circuit with Screen or Air Separator. Open door accessibility. Many sizes. No scrapers, plows, pushers, or shields.



CRUSHING ROLLS for granulation, coarse or fine, hard or soft materials. Automatic adjustments. Crushing shocks balanced. For dry or wet reduction. Sizes 8 x 5 to 38 x 20. The standard for abrasives.



SWING-SLEDGE MILLS for coarse and medium reduction (down to 20 mesh). Open door accessibility. Soft, moderately hard, tough or fibrous substances. Built in several types and many sizes.

AIR SEPARATOR for separation of fines to 325 mesh and finer. Increases output from 25% to 300%... lowers power costs by 50%. Capacities ¼ to 50 tons per hour output.

*Registered trademark of the Sturtevant Mill Company

STURTEVANT MILL COMPANY

101 CLAYTON STREET, BOSTON 22, MASS.

DESIGNERS & MANUFACTURERS OF DENS AND EXCAVATORS • MIXERS • SCREENS • PULVERIZERS • ELEVATORS • AND COMPLETE FERTILIZER UNITS

PULLING POWER

by Goodman

Tailored to fit the job like a glove!

This rugged locomotive is typical of hundreds built by Goodman for metal mine service, after a thorough study of job requirements.

Its over-all length was determined by a 12′ mine cage. 13 ton weight to provide good traction on wet track was requisite. A cable reel had to be provided for operation beyond limits of the trolley wire. Good visibility for the motorman over locomotive and high cars was important. All working parts and electrical units had to be fully protected from water and muck. Ample roadway clearance was imperative.

There were other requirements too, such as heaters on the sand box to keep the sand dry, and a handy foot-step for the motorman, to facilitate getting into and out of the cab. No detail was too small for full consideration.

What Goodman has done for other mine operators, Goodman can do for you. We shall be glad to analyze your locomotive requirements—without obligation on your part.

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MANUFACTURING COMPANY
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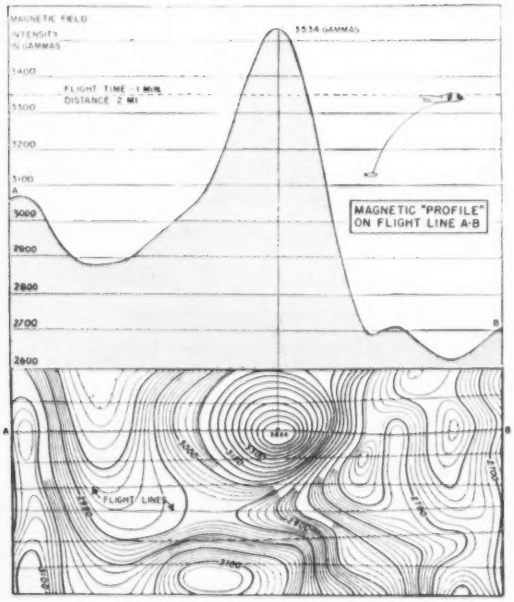
Cutting Machines · Conveyors · Loaders · Shuttle Cars · Locomotives · Continuous Miners

Airborne Magnetometer at work near Johannesburg

New Aerial Methods can in Exploration and



Profile of an ore body

The high hopes that mineral exploration would be greatly aided by the airborne magnetometer have been realized. Pay-off finds are being made, often in blind areas. And mining engineers are speeding the planning and development for these and other areas with photo-reconnaissance and aerial topographic maps.

The most important new aid to mining exploration today is the airborne magnetometer. With it AERO is helping to uncover major new mineral finds in the United States, Canada, South America and Africa. A typical recent discovery was a massive magnetite body, at a depth of about 2,000 ft., with no surface expression. It was located through an aeromagnetic survey of 900,000 acres in eastern Pennsylvania, flown in 30 days. In Canada, the airborne magnetometer revealed another large magnetite body near Marmora and deposits in Labrador and other areas.

Magnetic peaks such as this, over an iron ore deposit, are recorded by the airborne magnetometer. Major finds of iron, nickel, titanium, and asbestos have been made with the aid of the flying magnetometer.

Photo-maps for reconnaissance ... topo maps to speed engineering plans

Swift, low-cost reconnaissance is obtained with air photos. They are useful for geologic study—and as photo-maps for plotting property lines and bore holes, locating spoil dumps, and other planning.

Richly detailed, dependable topographic maps are compiled by aerial methods at a fraction of the cost and time for ground surveys. They are used for all types of engineering planning.

save time and money Development programs

AERO'S experienced crews have aided the search for nickel, titanium, asbestos, iron, and other minerals. Exploration costs usually are only a few cents per acre. In a number of cases, the magnetic data was so direct and positive that claims parties were dispatched within 24 hours after the survey flights. In fact, the magnetic data often is so revealing that large mining companies find it to be worthwhile for their chief geologists to go into the field with the air survey group. At the advance base they evaluate and act upon the aeromagnetic data as it is collected day by day.

Supplementing the airborne magnetometer is another aerial survey tool—the mapping camera. At low cost it rapidly collects information about surface geology. The air photos are compiled in photomaps, which are used for broad exploration planning, to plot property lines and bore holes, to locate spoil dumps and reclamation areas, and for general planning.

AERO topographic maps further speed the mining engineer's planning. These maps are compiled at one-half of the cost and time of ground surveys (*or less*). They aid in the location of access roads, rail spurs, town sites, harbor facilities, and help with other development planning. AERO's maps are so dependable they are used to estimate cut and fill for earthwork bids. Recent typical assignment: mapping Cerro Bolivar—2 meter contours, and scale of 1:1000. The maps will be used for engineering planning and management discussions.

These tested new aerial methods are especially valuable in first stages of mining exploration or development, when time and manpower saved can so greatly advance the date when actual mining operations begin. Our 34 years experience in exploration and mapping will be helpful to you.

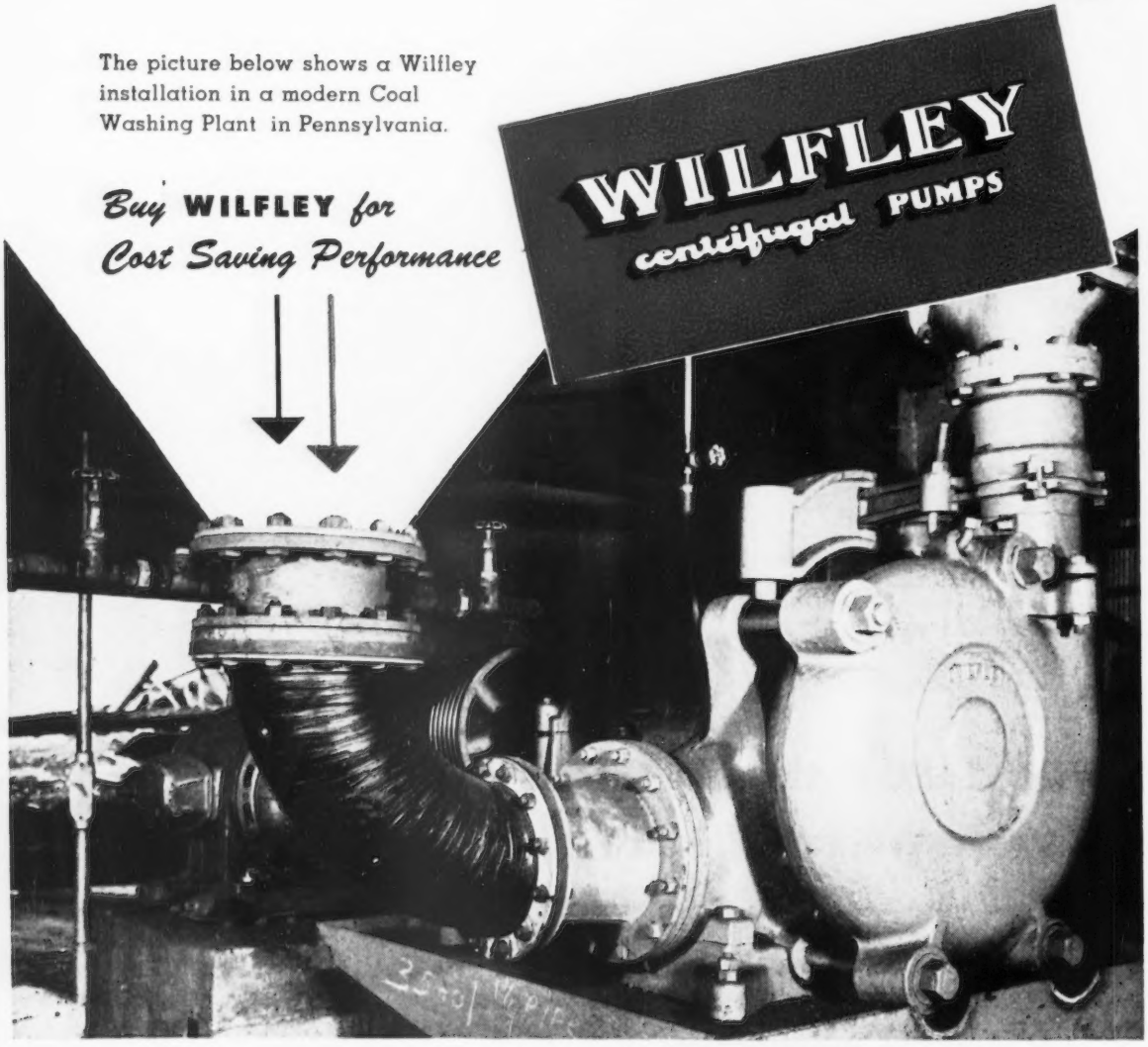
AERO SERVICE CORPORATION
PHILADELPHIA 20

Oldest Flying Corporation in the World, whose crews are at work all over the globe on airborne magnetometer surveys, photo-maps, topographic maps, relief models and Shoran-controlled mapping.

coal cleaning

The picture below shows a Wilfley installation in a modern Coal Washing Plant in Pennsylvania.

Buy **WILFLEY** *for Cost Saving Performance*



In coal washing operations Wilfley Sand Pumps always turn in a notably efficient and economical performance. These rugged, dependable pumps deliver continuous, trouble-free performance on a 'round-the-clock schedule—make measurable savings in operating and maintenance costs. Individual engineering on every application. Write or wire for complete details.

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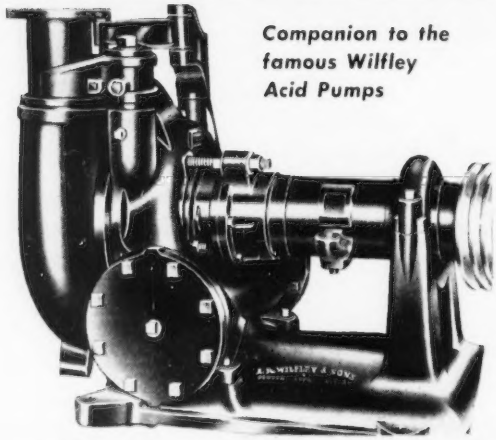
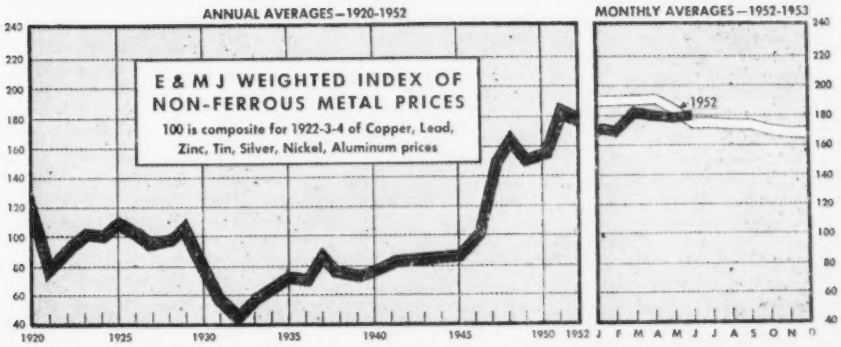


Companion to the famous Wilfley Acid Pumps

E&MJ OUTLOOK

PRICES



MARKETS

Surprising strength runs through the copper market. Fabricators, now filling most of their needs with 30¢ copper, can still sell at the old combined 30-36½¢ basis. Until defense, automobile, and electrical business slackens and forces them to climb down, they'll keep right on.

Although delayed, some decline in metal consumption seems in line for the third quarter, but the drop will likely be quite moderate. Lead was up to 13½¢ on an improved London market; tin sold off as supply improved and Korean peace seemed nearer; Lake Superior iron ore advanced.

The *E&MJ* index of non-ferrous metal prices climbed to 182.63 for June, against 181.58 for May, and 179.18 a year ago.

•

LABOR

The American Metal-Mine, Mill agreement at Carteret, N.J., on an 8½¢ per hr. wage boost is the first settlement in the major copper contracts now pending. In Canada, Inco settled with Mine, Mill at 5¢ plus benefits.

•

AT HOME

Continued governmental deficits, plus impending wage increases, had many looking for more inflation as June ended. It's likely the general trend of prices will continue upward, but there's still a let-down due late this year.

The DMPA will give $500,000 to E. S. Nossen Labs., Paterson, N.J., for pilot plant work on Maine's manganese ores. The Nossen process is a nitric acid leach, somewhat like the old USBM technique.

Nickel-cadmium batteries may give lead-acid types food for thought. An imported French battery will be tried by the government. A Ni-Cd battery for your car would cost about $100, so don't plan on it just yet.

The sliding-scale import tax on lead and zinc (H.R. 5496) will be rewritten and may come up again after the Congressional recess.

Fluorine recaptured from potlines is now successfully going into synthetic cryolite at Reynolds Metals' Longview, Wash., plant.

Leaching in place, discussed but not used since the Ohio Copper Co. days, will be tried by Copper Creek Mining Co., Pinal County, Ariz.

•

ABROAD

That New Brunswick lead-zinc district looks better right along. It will be two or three months before accurate estimates of reserves are in, but a major district seems in the making.

Soviet offerings of platinum in London are probably only a Russian effort to get sterling, not another twig on the Kremlin's olive branch.

Chile stands fast on the 36½¢ price, but copper's backing up down there, probably more than they'd admit to.

MARKETS—Trends and Prices

Copper Industry Awaits Move by Chile—Lead Price Raised to 13½¢ on Steady Buying

EXCEPT FOR A CONTRACTION in business outside of the United States, which showed signs of betterment as June ended, the first half of 1953 was a period of high activity. The Federal Reserve Board's index of industrial activity for this country averaged a shade under 241% of the 1935-39 average, which compares with 216% in the Jan.-June period of 1952. Defense business, automobile production, and general construction combined to support business at a record level at fabricating plants producing metal products.

Deflationary forces were more pronounced in the first quarter of the year than in the second-quarter period. The steel industry unexpectedly granted workers an increase in hourly wages of 8½¢ on June 12, which set off a general rise in prices of steel products and iron ore produced in the Lake Superior region. Credit terms were eased on banks by the Federal Reserve, to take care of Government financing along with a seasonal demand for extra funds. These developments aided in dissipating much of the bearishness over the immediate outlook which was particularly pronounced in copper toward the end of May. Fresh obstacles to a Korean truce also influenced sentiment.

Price Index Higher

The *E & MJ* index of nonferrous metal prices rose moderately from 181.58 in May to 182.63 in June. Lower tin prices were offset by a recovery in lead. Copper, domestic and foreign, virtually sold on an even basis in all important trading centers, Chile excepted. Despite continued unsettlement in zinc abroad, smelters in the United States managed to hold on to the 11¢ East St. Louis basis for the fourth consecutive month. Orderly marketing in foreign silver easily supported the price at 85¼¢ an ounce.

The Controlled Materials Plan passed out of existence as June ended and priorities came into the picture under the Defense Materials System. NPA dropped allocation and inventory controls on cobalt, chromium, and molybdenum. Restrictions on use of columbium and tantalum were eased. The only important metal still under control is nickel.

In the field of precious metals, attention centered in platinum. The price firmed up on sustained buying for industrial purposes and purchases for the U. S. stockpile. As a result of this activity, the market advanced $3 an ounce troy to the basis of $93 @ $95. Traders were concerned as June ended on reports from London indicating that Russia is a seller in the world market. Demand for platinum from the jewelry industry has been disappointing to traders. Jewelers have been using palladium on a more extensive scale because of availability and price.

Effective July 1, the British authorities turned over the job of importing aluminum for the United Kingdom to private industry.

Chile's Copper Dilemma

Chile's copper committee failed to take any action during June in the matter of bringing down its fixed price to that of the world market. The delay undoubtedly springs from the political and financial aspects of the problem. Copper is beginning to accumulate in Chile and market authorities here and abroad are deeply concerned over this unfavorable trend. An unexpected byproduct of Chile's action to date is the obvious stability that the 35½¢ price has imparted to the 30¢ level prevailing on the bulk of the world's copper output. In other words, Chile has been holding an umbrella over the market.

Commenting on the copper situation, Simon D. Strauss, vice president of the American Smelting & Refining Co., said: "Trading in copper futures in London will begin on August 5. Possibly this will be the catalyst that will precipitate action by the Chileans. Taking into consideration the cost of production of most of the world's copper and the competitive position with aluminum (currently selling at 20¢ a pound), the present price of the red metal at 30¢ a pound seems on the high side."

Edgar Sengier, chairman of Katanga, Belgian Congo producer, declared the recent recline in copper prices was considered by the company as a trend toward a more healthy position. Katanga produced 205,749 metric tons of copper during 1952.

The key to the copper situation in the United States is in the hands of fabricators. They have been obtaining most of their supplies at 30¢ a pound and pricing their products at 32.6¢. Though competition in copper products is increasing, deviation from the selling basis so far has been insignificant. Once this condition changes, however, the entire market will soften. Fabricators obtained 146,815 tons of refined copper during May, which compares with 142,282 tons in April, Copper Institute reports. These large deliveries were possible because of unusually heavy imports from various sources. April imports, the latest month available, totaled 63,797 tons, of which 6,397 tons was contained in ore, matte, etc., 26,516 tons was blister (copper content), and 30,884 tons refined.

Lead at 13½¢, N. Y.

A recovery in London's speculative market was followed by a gradual return of confidence on the part of domestic lead consumers. Demand for lead in the U. S. was active throughout June and the price moved up to 13½¢, N. Y., on June 11. There was less selling pressure in lead from foreign sources and imports in the second half of the year may be reduced substantially compared with those of the first half.

Prompt lead on the London Metal Exchange advanced about £5 per long ton during the month, settling at £91

Average Prices for June (E&MJ Quotations)

Copper:	
Electrolytic, domestic, refinery	29.688
Electrolytic, export, refinery ..	29.699
Lead	
Common, New York	13.413
Common, St. Louis	13.213
Silver and Sterling Exchange:	
Silver, New York per oz.	85.250
Silver, London, pence per oz. ..	74.000
Sterling Exchange, "Checks"	281.366
Zinc:	
Prime Western East St. Louis	11.000
Tin:	
New York Straits	92.899
New York, 99% min. ....(e)	91.899
Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	$191.923
Antimony (E&MJ) (d)	37.970
Antimony, bulk, Laredo	34.500
Antimony, in cases, Laredo	35.000
Platinum, refined, per oz. ..	$92.654
Cadmium (a)	200.000
Cadmium (b)	207.500
Cadmium (c)	215.000
Aluminum, 99% plus, ingot	20.500
Magnesium, ingot	27.000
Nickel (f)	60.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lbs.
(a) Cadmium average based on the producers' quotations.
(b) Cadmium average based on the average of the producers' and platers' quotation.
(c) Cadmium average based on platers' quotation.
(d) Domestic, 5 tons or more but less than carload lot, packed in cases, f.o.b. New York.
(e) Tin content.
(f) F.o.b. Port Colborne, U.S. duty included.

Markets Continued on Page 86

asked, equivalent to 11.38¢ a pound.

Slab zinc production in this country totaled 82,422 tons in May, against 80,459 tons in April. The daily rate for both months was about the same. Smelters operating outside of this country also are producing zinc at a fairly high rate. Until smelter output is finally reduced because of a shrinkage in the supply of concentrates, marked improvement in the price structure is unlikely. The U. S. market was maintained at 11¢ in the face of lower prices abroad. Stocks of 92,452 tons on hand as May ended were not looked upon by smelter men as excessive. The price is at or near bottom, operators believe.

"Free" Gold Market

Price movements in "free" gold were irregular throughout June, reflecting continued tension over political developments. The volume of business increased about 6%. Bar gold in European centers was lower, whereas in Buenos Aires prices improved. Pick's World Currency Report quotes on "free" gold as follows, per fine oz.:

	COINS		BARS (12.5 kg.)	
	May 29	June 30	May 29	June 30
NEW YORK, transit	...	...	$36.95	$36.55
MANILA	$46.00	$43.75	38.25	35.60
HONG KONG	45.25	45.00	39.60	39.30
BOMBAY	47.00	48.10	47.50	47.60
TANGIER	46.50	44.25	36.90	36.55
BEYROUTH	44.75	44.25	37.10	36.65
PARIS	50.60	50.25	38.20	37.50
BUENOS AIRES	45.75	45.00	39.75	41.00

Note: All prices are computed at the free or black market value of the U. S. dollar in the local markets.

Major Metals

U. S. DAILY AND AVERAGE PRICES

June 1953	Electrolytic Copper (a) Domestic	Electrolytic Copper (b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc East St. Louis
1	29.700	29.750	95.000	13.250	13.050	11.000
2	29.675	29.800	95.000	13.250	13.050	11.000
3	29.700	29.825	96.000	13.250	13.050	11.000
4	29.675	29.800	95.500	13.250	13.050	11.000
5	29.700	29.675	93.500	13.250	13.050	11.000
6	No Market	29.850	93.500	13.250	13.050	11.000
8	29.700	29.825	92.750	13.250	13.050	11.000
9	29.675	29.800	91.750	13.250	13.050	11.000
10	29.675	29.775	92.000	13.250	13.050	11.000
11	29.675	29.850	93.000	13.500	13.300	11.000
12	29.675	29.700	93.500	13.500	13.300	11.000
13	No Market	29.825	93.500	13.500	13.300	11.000
15	29.675	29.725	93.000	13.500	13.300	11.000
16	29.675	29.750	92.500	13.500	13.300	11.000
17	29.700	29.575	92.000	13.500	13.300	11.000
18	29.700	29.550	92.000	13.500	13.300	11.000
19	29.700	29.575	92.500	13.500	13.300	11.000
20	No Market	29.575	92.500	13.500	13.300	11.000
22	29.675	29.650	93.500	13.500	13.300	11.000
23	29.700	29.625	93.875	13.500	13.300	11.000
24	29.700	29.625	93.500	13.500	13.300	11.000
25	29.700	29.575	91.750	13.500	13.300	11.000
26	29.675	29.625	91.000	13.500	13.300	11.000
27	No Market	29.625	91.000	13.500	13.300	11.000
29	29.700	29.600	90.500	13.500	13.300	11.000
30	29.675	29.625	90.750	13.500	13.300	11.000
AVERAGES FOR MONTH						
June	29.688	29.699	92.899	13.413	13.213	11.000
AVERAGES FOR WEEK						
June						
3	29.695	29.742	95.500	13.250	13.050	11.000
10	29.685	29.788	93.167	13.250	13.050	11.000
17	29.680	29.738	92.917	13.500	13.300	11.000
24	29.695	29.600	92.979	13.500	13.300	11.000
CALENDAR WEEK AVERAGES						
June						
6	29.690	29.783	94.750	13.250	13.050	11.000
13	29.680	29.796	92.750	13.375	13.175	11.000
20	29.690	29.625	92.417	13.500	13.300	11.000
27	29.690	29.621	92.438	13.500	13.300	11.000

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

June 1953	Sterling Exchange "Checks"	Silver (c) New York	Silver (c) London	Gold London	Gold (d) United States
1	281.3125	85.250	74.000d.	248s.	$35.00
2	281.2500	85.250	Holiday	Holiday	35.00
3	281.3125	85.250	74.000d.	248s.	35.00
4	281.3125	85.250	74.000d.	248s.	35.00
5	281.3125	85.250	74.000d.	248s.	35.00
6	(e)	(e)	(e)	(e)	35.00
8	281.3125	85.250	74.000d.	248s.	35.00
9	281.3750	85.250	74.000d.	248s.	35.00
10	281.3750	85.250	74.000d.	248s.	35.00
11	281.3750	85.250	74.000d.	248s.	35.00
12	281.3750	85.250	74.000d.	248s.	35.00
13	(e)	(e)	(e)	(e)	35.00
15	281.3125	85.250	74.000d.	248s.	35.00
16	281.3750	85.250	74.000d.	248s.	35.00
17	281.4375	85.250	74.000d.	248s.	35.00
18	281.4375	85.250	74.000d.	248s.	35.00
19	281.3750	85.250	74.000d.	248s.	35.00
20	(e)	(e)	(e)	(e)	35.00
22	281.4375	85.250	74.000d.	248s.	35.00
23	281.4375	85.250	74.000d.	248s.	35.00
24	281.4375	85.250	74.000d.	248s.	35.00
25	281.3750	85.250	74.000d.	248s.	35.00
26	281.3750	85.250	74.000d.	248s.	35.00
27	(e)	(e)	(e)	(e)	35.00
29	281.3750	85.250	74.000d.	248s.	35.00
30	281.3750	85.250	74.000d.	248s.	35.00
AVERAGES FOR MONTH					
June	281.366	85.250	74.000d.	—	35.00
AVERAGES FOR WEEK					
June					
3	281.288	85.250	—	—	—
10	281.338	85.250	—	—	—
17	281.375	85.250	—	—	—
24	281.425	85.250	—	—	—

Calendar Week Averages, New York Silver: June 6th, 85.250; 13th, 85.250; 20th, 85.250; 27th, 85.250.

(e) No Market (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c. per pound, the average differential for delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingotbars; cathodes are sold at a discount of 0.125c. to 0.15c. per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered, in the East, Middle West, and West, effective Jan. 1, 1951, commanded a premium of 1.35c. per pound over the current market for Prime Western; Special High Grade 1.50c.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points.

(c) The daily New York silver quotation reported by Handy & Harman is for silver contained in ores and other unrefined silver-bearing materials, in cents and fractions of a cent per troy ounce. It is determined by Handy & Harman on the basis of actual sales of bar silver .999 fine in amounts of 50,000 ounces or more for nearby delivery at New York, as reported daily by regular suppliers, and is usually one-quarter-cent below the price paid for such bar silver, this deduction being the allowance to such suppliers for carrying, delivering and marketing. In addition to foreign silver, the quotations also apply to domestic silver if such silver enters into the New York market.

The Treasury's purchase price of newly mined domestic silver is 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U.S. Treasury's gold price. Actual payment by the United States Treasury for gold is at .99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Zinc Ore Production by Principal Countries

(American Bureau of Metal Statistics)

This report summarizes the production of zinc ore or concentrates by important countries. In addition to Russia and the countries under Russian influence, countries missing are Yugoslavia, Peru, and the Belgian Congo. Figures are in short tons.

	Jan.-Dec. 1951	Jan.-Dec. 1952	Jan. 1953	Feb. 1953	Mar. 1953
United States (a)	681,189	661,023	54,035	49,506	51,803
Canada (b)	341,112	366,775	32,474	33,275	36,811
Mexico (c)	205,575	228,428	19,946	18,856	18,636
Argentina	17,058	16,998	1,373	841	1,501
Fed. Rep. of Germany	80,398	88,933	7,792	7,791	8,182
Italy (e)	94,086	97,605	8,419	7,644	8,308
Spain (f)	79,298	84,551	6,550	6,163	....
Sweden (g)	38,350	49,061	1,124	561	....
Australia (d)	179,507	232,858	14,801	20,992	22,371
Japan	70,861	95,291	7,463	....	....
North Africa (h)	35,790	48,029	4,626	....	....
South West Africa (d)	11,110	16,553	1,117	1,060	820
Rhodesia (i)	25,301	25,637	2,150	1,971	2,240
Sub-total	1,859,635	2,011,742	161,870	....	....
Bolivia (d)	33,659	39,300j			
Totals	1,893,294	2,051,042			

(a) As reported by U.S.B.M. as production for all purposes. (b) New refined zinc plus recoverable zinc in ores and concentrates exported. (c) Production of zinc concentrates by flotation process, which falls a little short of the total. (d) 1951 yearly total is on a recoverable basis, other periods available by assay only. (e) Recoverable basis. (f) Partly estimated. (g) Estimated contents of exports. (h) Algeria, Tunisia and Morocco. (i) Same as slab zinc production. (j) Estimated.

U. S. Zinc Statistics

The May statistics of the American Zinc Institute revealed that stocks of slab zinc in the hands of smelters were reduced by 1,828 tons to 92,452 tons as the month ended. The peak in stocks this year was 99,864 tons on March 31.

Production continued at a high rate, averaging 2,659 tons a day, against 2,681 tons (revised) in April and 2,703 tons in May last year.

A summary of the April and May statistics, in tons, follows:

	(a) April	May
Stock at beginning	99,864	94,280
Production	80,459	82,422
Production, daily rate	2,681	2,659
Shipments:		
Domestic	78,211	75,648
Export-Drawback	215	259
Government acc't	7,617	8,343
	86,043	84,250
Stock at end	94,280	92,452
Unfilled orders	38,722	43,271

(a) Revised figures.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments f.o.b. New York unless otherwise stated

MISCELLANEOUS METALS

June 30, 1953

Aluminum ingot, 99 plus percent, lb.	20½¢.
Antimony, spot, lb., 5 tons and up but less than carload, packed in cases	37.97¢.
Bismuth, ton lots, lb.	$2.25
Cadmium, commercial sticks, delivered, lb.	$2.00
Calcium, lb., ton lots, 98 percent, cast	$2.05
Chromium, 97 percent grade, lb., contract	$1.18
Cobalt, 97 to 99 percent, per lb.	$2.40
Germanium, lb.	$340.00
Indium, troy oz.	$2.25
Lithium, lb., 98 percent	$11.00 @ $14.00
Nickel, cathodes, lb., f.o.b. Port Colborne (a)	60¢.
Magnesium, 99.8 percent, carloads, lb., producer's plant, Freeport, Texas	27¢.
Palladium, troy oz.	$22.00 @ $24.00
Platinum (Official quotation wholesale lots) troy oz.	$93.00
Quicksilver, flask of 76 lbs., 25 flasks or more	$191 @ $193
Selenium, 99 plus percent, lb.	$4.25 @ $4.75
Silicon, minimum 97 percent, carloads, lb.	18½¢.
Tellurium, lb.	$1.75
Thallium, 100 lb. or more, lb.	$12.50
Titanium, 99.3 plus, lb.	$5.00

(a) Include U.S. duty.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per unit	$46.00 @ $48.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry	
44% Cr_2O_3 no ratio	$27.00 @ $32.00
48% Cr_2O_3 3 to 1 ratio	$44.00 @ $56.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer (b)	$10.30
Mesabi bessemer (b)	$10.05
Mesabi, non-bessemer (b)	$9.90
Lead (Galena), 80 percent, Joplin, Mo., ton	$166.50
Manganese Ore—Per long ton unit of Mn basis 48 percent manganese, nearby positions, subject to premiums and penalties, $1.18 @ $1.21 c.i.f. U.S. ports, duty extra. Long-term contract nominal at 90c. to 93c., c.i.f. duty extra.	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	60¢.
Tantalite, 60% concentrate, per lb.	$2.50 @ $3.00
Tungsten Ore, per unit of WO_3	
Foreign, 60 percent, c.i.f. U.S. ports	$42.00 @ $43.00
Domestic, scheelite, 60 percent f.o.b. mill	$63.00
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	31¢.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo., per ton	$65.00

(a) F.o.b. port of shipment. (b) Effective July 1, 1953.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb., in bbl. carload lots delivered	5½¢.
Cobalt Oxide, 72½ to 73½%, ceramic grade, per lb.	$1.82 @$1.84½
Copper Sulphate, 100 lb.	$10.35
Germanium Oxide, lb.	$142.00

ALLOYS

Ferrochrome, 65 to 69 percent, per lb. of Cr contained	24¾¢.
Ferromanganese, 74–76%, net ton, seaboard	$200
Ferromolybdenum, 55 to 65 percent Mo. lb. of Mo. contained	$1.32
Ferrosilicon, 50 percent per lb. of contained Si	12.4¢.
Ferrotungsten, 75 to 80 percent, lb. of W contained	$4.35
Ferrovanadium, per lb. of V delivered	$3.00 @ $3.25
Silicomanganese, Max. 1½ percent carbon, per lb. contracts	11.4¢.
Spiegeleisen, per long ton, 19 @ 21 percent grade	$85.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds) ton:	
Crude No. 1	$960 @ $1,500
Crude No. 2	$595 @ $900
Spinning fibers	$321 @ $514
Sh ngle fibers	$150 @ $200
Paper stock	$109 @ $137
Waste	$77
Shorts	$35 @ $70
Asbestos, Vermont, f.o.b. Hyde Park:	
Spinning fibers	$279.50 @ $302.00
Shingle stock	$135.00 @ $162.00
Paper stock	$81.50 @ $115.00
Waste, stucco or plaster	$71.40
Refuse or Shorts	$34.00 @ $63.00
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$13.00 @ $14.00
Missouri, 94 percent $BaSO_4$, per short ton	$12.00
Bauxite, long ton, f.o.b. point of shipment:	
Domestic, crude, 50 to 52 percent (not dried)	(a) $5.00 @ $5.50
Domestic, chemical, 55 to 58 percent	(a) $8.50 @ $9.50
Domestic, abrasive, 80 to 84 percent	(a) $18.00 @ $18.50
China Clay, f.o.b. mines, ton:	
Georgia, filler and ceramic grades	$8.50 @ $9.50
North Carolina ceramic grade	$20.25 @ $22.25
Feldspar, bulk ton:	
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50 @ $22.25
Glass feldspar, white, 20 mesh	$11.75 @ $12.50
Fluorspar, f.o.b. mines, bulk, 70% effective ton	$42.50
60% effective CaF_2	$38.00
Acid 97% concentrate, bulk, ton	$60.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 @ $14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington	$39.56
Mica—Domestic, f.o.b. mines. Punch 12 to 22¢. per lb. according to size and quality. Sheet clear, 1½ x 2 inch, 80 to 85¢.; 2 x 2 inch, $1.10 to $1.20; 2 x 3 inch, $1.50 @ $1.60; 3 x 3 inch, $1.80 @ $1.90; 3 x 4 inch, $2.20; 3 x 5 inch, $2.40; 4 x 6 inch, $3.15; 6 x 8 inch, $4.25. Wet, ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground: $32.50 @ $70.00 per ton Scrap $32 and up.	
Ocher, Georgia, ton, in sacks	$26.25
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	Not quoted
Sulphur, Texas, mines, long ton	$25.50 @ $27.50
Talc, f.o.b. works, ton:	
New York, purified	$18.50 @ $20.00
Vermont, extra white	$12.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$30.00

(a) Nominal.

IRON AND STEEL

Pig Iron, gross ton, basic, Valley Furnaces	$5450
Steel f.o.b. Pittsburgh billets, net ton	$62.00
Structural shapes, 100 lb.	$4.10

ENGINEERING AND MINING JOURNAL

JULY, 1953

Mining's greatest era

TO ANYONE who feels that growth and opportunity are diminishing in the mining of metals and non-metallic minerals, we offer this issue in refutation.

We have read stories of the brave old days in Virginia City, Cripple Creek, the Klondike, and dozens of other famous camps, where individuals made, and often lost, fortunes overnight. We have envied, a little, the fun the men and women had who were lucky enough to be there when it all happened.

We have envied too, those engineers and geologists who were lucky enough to be a part of those great new developments like the porphyry coppers, the great gold mines, the big iron ore-bodies of the world.

But because we envy them, a little, does that mean we feel our own times are not to be envied, too? Certainly not. To us, these are the good old days, right here and now.

For one thing, there has never been a time in the history of mining when so great an investment was being made all over the world in new mining enterprises and in expansion of old ones. New projects are springing up everywhere, and investment runs into the billions of dollars. That spells opportunity for mining men, especially for capable, enterprising young men who realize that reputations and careers are most easily built on growth and change, not on routine production.

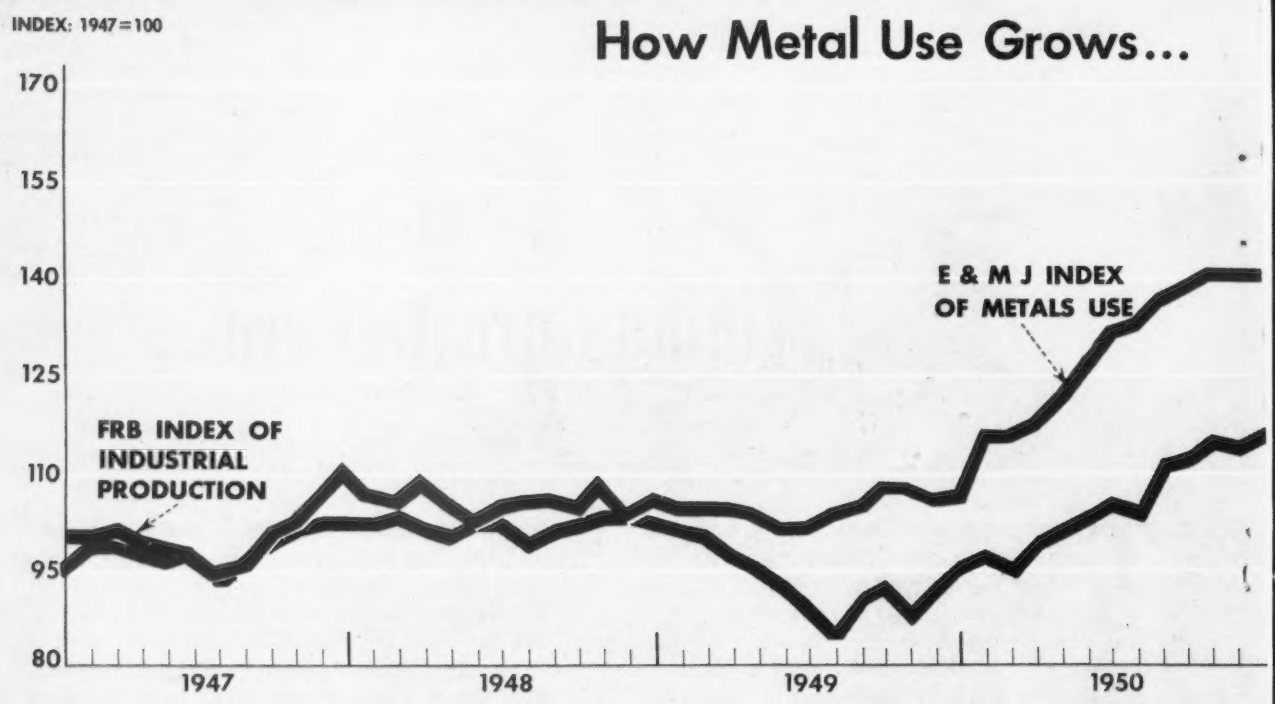
The future holds a new kind of excitement for mining men. Tomorrow's opportunities put a special premium on skill, engineering ability, judgment, and courage. For example, luck and high grade ore played no part whatever in developing Sherritt Gordon's Lynn Lake project, yet the men engaged in it know that skill in exploration, enterprising metallurgical research, and sound financial judgement have combined to produce what may, in fact, be a revolutionary new process as well as a new mine, a process that may upset traditional ideas and techniques all through the industry.

This growth in opportunity comes at a time when the management of mining is gradually shifting into younger hands. In mine after mine, a sort of second generation of management is either about to take control or has already done so.

We think this is all to the good. Obviously, mining needs the experience and conservative guidance of the men who built up the great producing mines of today. But mining needs even more the impatience with tradition, the open eager minds and the energy of younger men. Many of the projects described in this issue in the sections on aluminum, iron ore, nickel, copper, and others are directed by men young either in years or ideas, or both.

That's why we think of this as "Mining's Greatest Era." There are new projects wherever you look, new ideas at work, new opportunities waiting to be grasped by a new generation of mining's leaders. Who can doubt that the industry's best years are still ahead?

★



What The Next Decade

Ten years from now industrial production is likely to have increased by 20%, sparked by rapid growth in the electrical and chemical industries. Mining must expand accordingly.

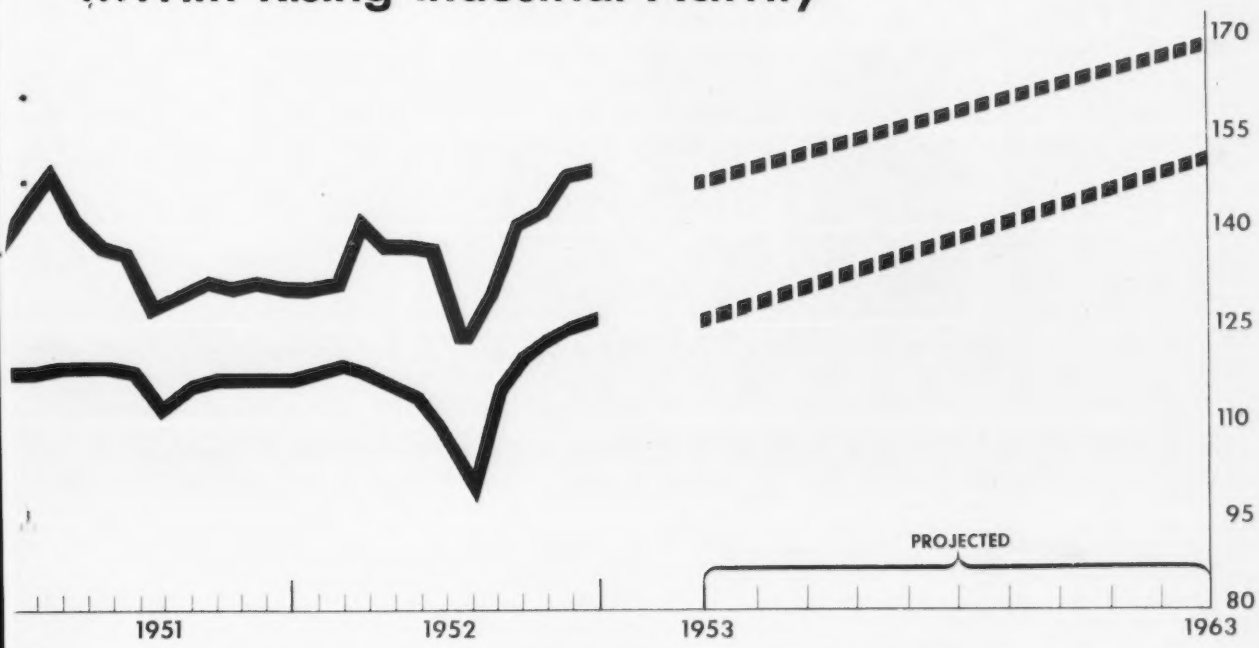
RICHARD EVERETT, ROBERT ULIN, DOUGLAS GREENWALD
McGraw-Hill Department of Economics

ANY ESTIMATE OF ACTIVITY in metal mining over the next ten years must be based on the prospect for American industry in general. Mining, as the chief supplier of raw materials, moves as industrial activity moves. Therefore the factors that make up the outlook for industry in the next decade, make up the outlook for mining, too.

Population growth, national defense, increased mechanization of both home and industrial environments, steadily rising standards of living, all these factors, and others, weave a clear-cut pattern of long-term growth for the American economy. Let's consider what the next ten years will mean to industry, and, in turn, what growing industrial demands will mean to mining and its products.

Normally, industrial production in the U. S. grows

...With Rising Industrial Activity



Source: Federal Reserve Board; *E&MJ Metal & Mineral Markets*. Estimates for 1953-1963 by McGraw-Hill Dept. of Economics.

Can Mean To Mining

about 3.5% per year. For the last five years, owing to the war in Korea, the average gain has been slightly more than 4%. No one expects this higher rate to last, in fact production may drop for a couple of years as defense work slows down.

Nevertheless, it seems a fairly safe bet that the Federal Reserve Board's index of industrial production will climb 20% to better than 280 by 1963, as indicated on the chart above. This year's level is 235. An economy steaming along at a 280 clip would chew up metal at a rate close to 170 on the *E&MJ* metal use index, as compared with a level of about 147 in 1953.

"What about cut-backs in defense orders?" you may ask. "What about an over-supply of automobiles?"

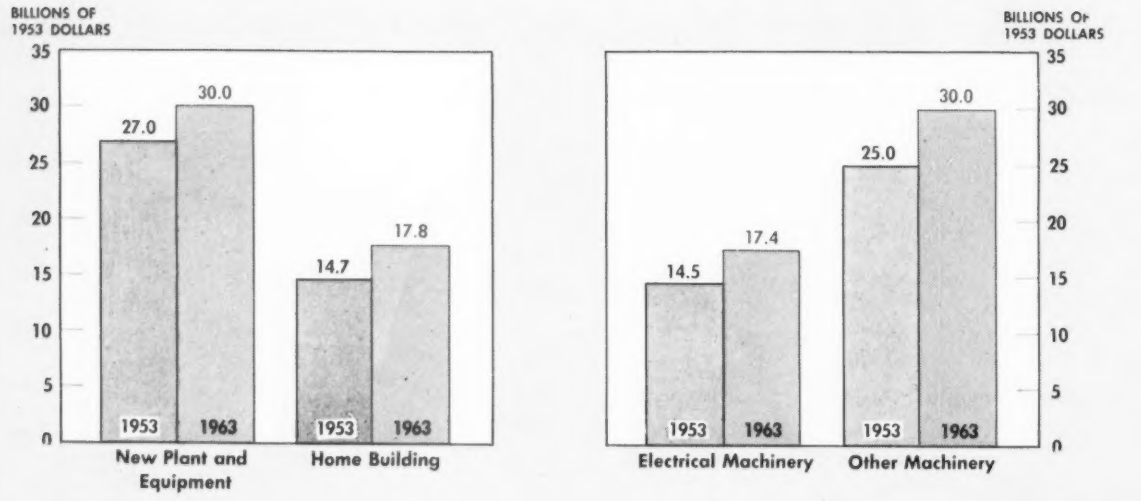
True enough, the prospect is still for a turn-down in business over the last half of the year, but we're talking about 1963. To do that, one must, as anyone in the mining industry must, see beyond short-term hazards and plan on the long-term outlook.

There are strong underlying growth trends at work in the world today. They mean greater demands on industry; they'll call for greater output from mines. Here are some of them.

Population will grow 15% or more in the next decade. This means greater needs for everything, from metal food containers to electric generators. Also population growth creates higher demands for metals than it used to, simply because each family unit buys far more gadgets than it used to. This is because . . .

Living standards are going up. As the National Planning Association points out in a study of the next ten years, the luxuries of yesterday become the necessities of today. This process, encompassing such things as dishwashers, power lawn mowers and air conditioners, will probably continue.

Industrial research is changing the technology of production so rapidly that business firms must spend continuously on new plants and equipment just to keep facilities up to date. Research expendi-



GROWTH in major metal-consuming industries over the next decade

tures are now running $4-billion per year, compared to about $1-billion in 1940.

Already, engineers say that completely automatic factories are entirely feasible for a wide variety of industries. As automation increases, the demand goes up for materials moving equipment, electric and electronic control devices, testing and measuring instruments.

New capacity to serve the growing population, and plant modernization, based on research, point to high expenditures on factory buildings and equipment for many years to come. A survey made earlier this year by the McGraw-Hill Department of Economics showed that spending of this type is scheduled to remain well above the pre-Korea level.

Manufacturers, as a group, plan to increase capacity 16% by the end of 1956. And they plan to spend even more heavily on modernization. Although these plans amount to somewhat less than the capital goods boom of 1952-53, they are very impressive compared to any other period.

Altogether, it's a picture of great vitality in both the consumer goods field and the capital equipment field.

For further reassurance, note that today consumers have over $160-billion of savings in cash or government bonds, more than $1,000 average for every person in the country.

Industrial expansion *after* 1963 is likely to be even more impressive than the 20% growth projected for the next ten years. The late '60s and early '70s may become the greatest period of economic growth since the U. S. became a modern industrial nation.

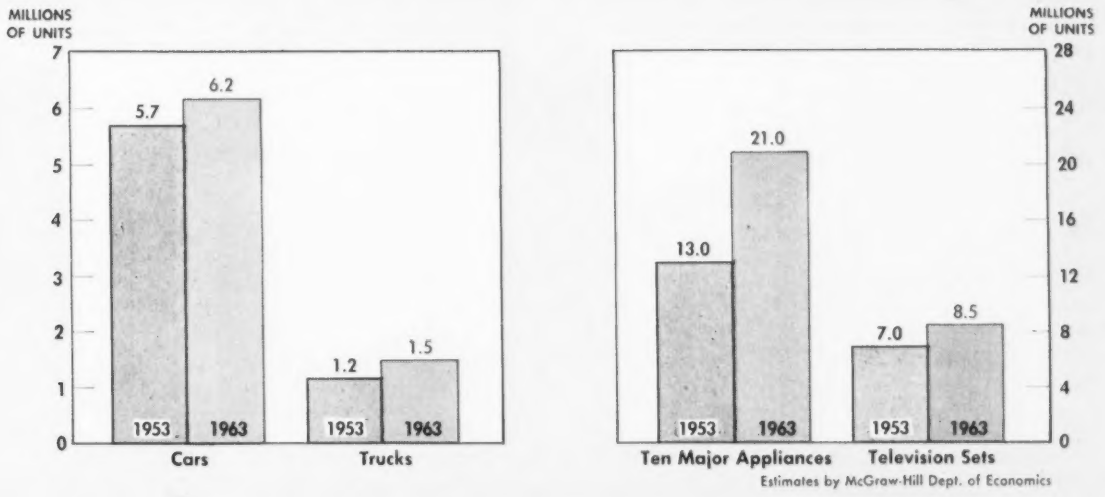
The reason appears in the makeup of the U. S. population. The biggest increase in the number of people of the common marrying ages 20-25 years, will come after 1963, as large numbers of wartime and postwar babies grow up. When they start getting married and buying homes, automobiles, appliances and other family goods, that's when the really big boom may come.

Perhaps the best evidence of the future trend is what businessmen are doing about it. Over 80% of the firms cooperating in a recent McGraw-Hill survey were planning new plants and equipment as much as four years ahead. Some leading companies in the chemical, electrical, oil, and automotive industries, had plans for 10 to 15 years ahead. Spending for new plant and equipment may reach $30-billion a year by 1963.

Foreign Demand To Grow

It's more difficult to project foreign material requirements into the future than it is to estimate U. S. needs. One reason is that much less is known about the economic situation in many foreign countries. Another is that other nations are more vulnerable to severe business fluctuations than the U. S. If we have even a slight recession here, many other countries will face real crises, as their trade with the U. S. falls off. Their economies are less self-contained, more affected by changes in foreign trade

However, in the long run, it seems likely that mineral consumption will grow faster abroad than in the United States. Industrial production will not grow as fast in Europe as in the U. S. But the European economy is shifting toward a greater concentration on metalworking industries. This is partly to increase exports, partly to raise domestic living standards nearer the U. S. pattern. So Europe's mineral requirements will increase fairly fast. And the less developed countries in Africa, Asia, and South America, which consume relatively small amounts of metal today, will raise consumption rapidly as their domestic industry expands.



. . . WILL DEVELOP higher demands for products of mineral industries.

The Outlook for Mineral Consuming Industries

In the next ten years, some industries will increase production far more than the 20% expected for manufacturing as a whole. And some lines will be producing less, perhaps a lot less, than in 1953.

Some of the greatest growth will come in industries making non-durable goods such as chemicals and petroleum products. Sales of goods that grow with the population, such as food and textiles, will also expand faster than sales of some durable goods industries.

Nevertheless, growth in the durable goods industries, the big users of metal, will be substantial. Here's a rundown of prospects for some major mineral-consuming industries and products.

Home Building—Expenditures on home building will be much higher by 1963. But the big increase is not likely to come from an increase in the number of homes being built.

Actually, houses built in 1963 will be bigger and better built than the average new house of recent years. In addition, people will be spending more to remodel and expand existing homes. Maintenance, repairs, remodeling and expansion of existing houses may amount to one quarter or more of total homebuilding activity by 1963.

Public Construction—Public construction is expected to increase sharply over the next ten years. Of course, military and atomic energy construction for the Federal government will probably decline. But state and local work will increase much more rapidly than Federal work declines.

In fact, the years between now and the mid-'60s may see the greatest burst of state and local construction in history. Needs for roads, schools, hospitals and other public facilities are so great today that there is little chance of making them all up by 1963. For instance, experts say it would take 10 to 15 years (or more) to meet the need for highways, even by building them at twice the 1953 rate.

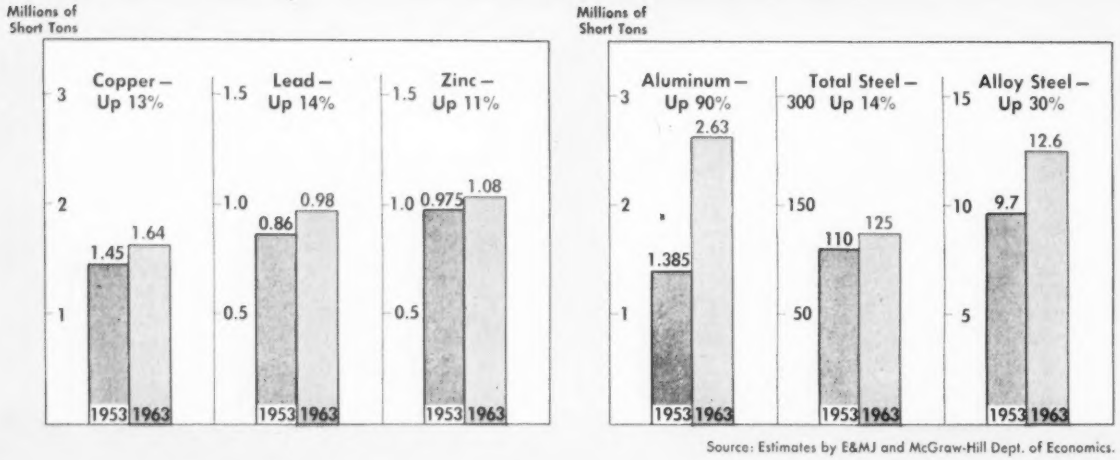
Machinery—Output of machinery will have to grow by about 20% to meet the needs of business firms in 1963. Most of the growth will be in new, specialized fields—like chemical processing, electronics, materials handling and packaging equipment.

Production of **office machinery**, in particular, will be much higher than it is today. Office machinery has one of the most promising growth prospects in the entire economy.

Electrical Machinery—Sales of electrical machinery should grow at least 20%, as electrical utilities strive to meet the rapid expansion in demand for electricity. Sales of electricity generally double every ten years, and the next ten are expected to fit this historical schedule. Growth in electricity use will mean not only greater sales of generating equipment but also great demand for wire and cable and other transmission apparatus.

Both utilities and the makers of electrical machinery will expand rapidly to meet the nation's needs for electricity. Many of them already have expansion plans running far into the future. The General Electric Company, for instance, plans to spend more than $500-million on new plant and equipment in the next three years. The Philadelphia Electric Company expects to spend about $385-million in the years 1953-58 to meet mushrooming electric power requirements in the Delaware Valley.

Nucleonics may raise the power industry's bill of



Source: Estimates by E&MJ and McGraw-Hill Dept. of Economics.

HOW U. S. CONSUMPTION of metals may grow. World's use may grow faster.

materials. By 1963, generation of electricity in nuclear power plants may have become practical—and nuclear plants even now require larger amounts of material and equipment than conventional generating facilities.

Aircraft—This is a problem industry—but one with great possibilities. Its level of production depends heavily on the military situation, since the vast bulk of aircraft go to the Armed Services. If there is no war in the meantime, defense production will have declined to a maintenance level by 1963. A maintenance level would still call for a lot of aircraft, but nothing like the quantity to be produced in the next few years.

However, the prospect of a decline in aircraft production is by no means assured. The industry has a promising "new product" in the helicopter. If a good, inexpensive helicopter reaches the market in the next ten years, the aircraft industry could easily shift from decline to boom.

Autos and Trucks—The current year will be a big one for automobile assemblies. Even 1963 is not likely to be much higher. Sales will gain some because of higher replacement needs, which increase with the number of cars in use. They will also gain from some increase in the number of two-car families. New car sales may be up by 500,000 or so in 1963.

However, actual consumption of metals in the automobile industry will increase substantially more than the number of car sales would indicate. For one thing, truck sales will grow much faster—perhaps 25% in ten years. And the cars built in 1963 will be larger and heavier than today's typical automobile. There will probably be much greater sales of special vehicles like station wagons. And more cars will contain air conditioning and other complicated equipment. Today's special "extras" will be standard in a few years.

Electrical Appliances—Sales of electrical appliances will grow rapidly in the next ten years. The newer appliances, like home freezers, dryers and ironers will lead the gains. Even old established items like refrigerators can look forward to some sales growth.

The chart on page 91 shows growth possibilities for ten major appliances, including both the old standbys and some of the newer appliances. Sales of these appliances will total about 13 million this year and are expected to reach 21 million or more by 1963.

TV ownership is not expected to grow so rapidly in the next ten years. But almost everyone will have a television set in 1963, and replacement sales will be large. Introduction of color television will still be a factor in promoting replacement sales.

Chemicals—The chemical industries will grow much faster than the economy as a whole, as they generally do. The industries are constantly developing new products which expand markets. Chemical plants already supply more than 20% of U. S. textile fiber requirements and may double their share by 1963.

Petrochemicals, made from oil and natural gas are growing rapidly. And production of plastics is expected to increase sharply, which means continued competition for metals in many applications. Total chemical production will grow 50% or more in the next ten years.

Oil and Gas—The oil and gas industry is another that grows faster than the general economy. Demand for domestic refinery products typically expands by about 4% per year. Over ten years, that means total growth of about 50%.

This is the prospect for only a few of the more rapidly expanding industries. Many others, some of them important consumers of metals, will share in this growth. Without dwelling on details, it can

be said that in most industries the outlook for the next ten years is for a growth near the over-all industrial average of 20%.

This brings us to the question of what such growth means to specific metals and minerals.

Outlook for Major Minerals

The outlook for overall growth in mineral use by 1963 conceals a wide range of prospects for individual minerals. Projections shown on the accompanying charts range from 11% growth to 90%. Some of the younger metals, like titanium and magnesium have a growth potential vastly greater than any of the older metals.

Iron and Steel—Iron and steel are the basic metals in the economy, in spite of the rapid growth of aluminum and other competitive materials. They will still be basic in 1963. Steel consumption will expand as a result of growth in sales of machinery, oil field equipment, cars and trucks, and the expected increase in heavy construction. Consumption may run around 125 million tons (ingots) in an average year in the early 1960s. Iron consumption in other uses is also expected to grow as a result of improvements in alloying.

Alloy Steel—Use of alloy steels will grow much faster than total steel use in the future. Modern technology will continue to require larger quantities of high-temperature, super-strong, corrosion-resistant alloys for airplane engines, cutting tools, chemical processing equipment, and other purposes. See the article on "New Metals" p. 94.

Total alloy steel production this year will probably be about 9.7 million tons. By 1963, it may reach 12.6 million tons, up 30% in ten years. And consumption of ferro alloys will increase much faster than this. Future alloys of steel will need greater content of the alloying elements to resist the strains of high-speed machinery and corrosive chemicals. In addition, larger amounts of ferro alloys and other additives, such as the rare earths, will be used in metals other than iron and steel,—magnesium and aluminum for example.

Copper—Consumption of copper is expected to grow about 13% in the next ten years. All of its major uses will be expanding substantially. Electrical machinery, construction, and radio and TV are expected to grow about 20%, automobile production about 10%. The U. S. will be using close to 1,650,000 tons of primary copper by 1963, compared to perhaps 1,450,000 tons this year.

Actually, copper use could be much greater, or smaller, than this projected amount in 1963, depending on two developments. One is the competition with aluminum. No one expects aluminum to cut far enough into copper use to cause a decline in consumption. But competition will be a serious problem as long as aluminum maintains anything like its present price advantage.

The other factor is air conditioning, both in the home and in the factory and office. Air conditioning is today only a relatively minor factor in copper use. But many people in the housing field believe that almost all new houses will include air conditioning systems in the future. If air conditioning goes into a million new homes in 1963, it will rival automobiles as a copper user.

Lead—Lead use is expected to grow about as fast as copper consumption, although there are not the spectacular new uses foreseen for copper. Lead is a basic material that benefits strongly from general economic growth. Major uses, in storage batteries, cables, construction, gasoline and paint, will all expand steadily in the next ten years.

Zinc—Demand for zinc is expected to grow by about 11% between now and 1963. Of the chief uses, galvanizing is likely to grow fastest. Competition of aluminum with brass and bronze, and of aluminum and magnesium with zinc for die casting, is expected to hold growth for those uses to lower levels.

Aluminum—Aluminum promises to be the "growth" metal of the next ten years. Only a few of the small-volume metals will grow faster. Use in 1963 is projected at 90% above the 1953 level.

This growth, if it is achieved, will be all the more remarkable because of the loss of military business that is expected between now and 1963. A decline in defense expenditures to a maintenance level would knock out heavy demand for aluminum for aircraft.

Building construction will probably be the major user of aluminum in 1963. Aluminum is capturing a large part of the market for doors and windows in homes. It has become a popular material for roofs and walls in farm dwellings, for walls in factories and office buildings and in numerous other applications. By 1963, construction may be using as much aluminum as went into all uses in 1950.

Growth in production of consumer durables will also benefit aluminum. Aluminum gains not only by the expected increase in sales of appliances and automobiles, but also from the fact that more of it will be used in future products. Automobiles, for instance, contain only a few pounds of aluminum today. But aluminum producers expect to boost auto use of their product materially now that a large supply of aluminum has been assured. And one of the really big dreams of the aluminum producers, to get an aluminum engine block into every automobile, might mean consumption of more than half a million tons of aluminum in cars yearly.

Fluorspar—Consumption of fluorspar will benefit from the big expansions in prospect for the aluminum and chemical industries. Consumption in steel making will also rise, as will use in making glass and enamel. Total demand for fluorspar is expected to increase by 40%-50% in ten years.

Sulphur—Consumption of sulphur may increase by 50% or more in the next ten years. The biggest user, fertilizer output, will have to expand by about 90% to supply the food for 1963's larger population. Use in the chemical industry and petroleum refining will also grow rapidly.

Phosphate rock—Consumption of phosphate rock will benefit from the increased use of fertilizer in the future, and should grow by about the same amount—90%.

Potash—Potash is another mineral that will gain because of the need for more fertilizer. It should grow at about the same rate as phosphate rock.

NEW METALS

New Metals . . . have limitations . . . but where useful . . . they're hard to do without.

Metal	Abundance*
Silicon	27.7%
Calcium	3.63
Sodium	2.83
Potassium	2.7
Titanium	0.44
Rubidium	0.035
Strontium	0.030
Barium	0.025
Zirconium	0.022
Lithium	0.0065
Cerium	0.0024
Columbium	0.0024
Lanthanum	0.0020
Gallium	0.0015
Thorium	0.0012
Cesium	0.0007
Hafnium	0.00045
Boron	0.0003
Germanium	0.0002**
Tantalum	0.0002
Thallium	0.0001
Beryllium	0.0001
Cadmium	10^{-5}
Indium	10^{-6}
Rhenium	10^{-7}

Poor Mechanical Properties
- Silicon
- Germanium
- Boron
- Gallium

Too active chemically for structural use
- Sodium
- Potassium
- Lithium
- Calcium
- Strontium
- Cesium
- Barium
- Rubidium

Useful Metallic Properties
- Titanium
- Zirconium
- Cerium
- Lanthanum
- Columbium
- Thorium
- Tantalum
- Beryllium
- Cadmium

Not Enough Is Known About These
- Hafnium
- Rhenium
- Indium
- Thallium

Electronic Applications
- Germanium
- Silicon

Coatings
- Silicon
- Boron

Important in Alloys
- Titanium
- Zirconium
- Cerium
- Lanthanum
- Columbium
- Beryllium
- Silicon
- Boron

Important as Metal
- Titanium
- Zirconium
- Beryllium
- Tantalum

Atomic Energy Field
- Thorium
- Zirconium
- Beryllium

Minor Alloying, Plating
- Cadmium
- Indium
- Calcium
- Lithium

Metallurgical Reduction
- Sodium
- Calcium

*Abundance figures are percentage in igneous rocks from "Geochemical Table of the Elements"; J. Green, *Bulletin of Geologic Society of America.* (In press)

**Percentage in basic rocks. Total in igneous rocks is 0.0035%.

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School of Mines
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THE ROLE FOR the newer metals in the coming decades will be as minor but often indispensable supplements to our metal supply. Except for titanium, none should approach major tonnage production in the near future. Their importance lies rather in the greater versatility they will permit metallurgy in meeting the newer and more severe demands of an age of supersonic speeds and nuclear energy.

The metals considered here are those which, for reasons of scarcity or difficulty in preparation, are only now beginning to find important application. Their overall usefulness, which must be based on cost and availability as well as desirable physical properties will be largely determined by the following:

1. Location and extent of mineral reserves.
2. Amenability to mining and ore dressing.
3. Ease of reduction of oxide to metal.
4. Ease of purification of metal.
5. Metallic properties.
   a. Density
   b. Mechanical properties
   c. Reactivity.

The above considerations refer to the use of a metal in pure form, or as an alloy base. It is often possible that a metal may not be usable in this form but may be valuable for any of the following more specialized applications:

1. Plating.
2. Coatings.
3. Minor alloying element.
4. Electronic applications.

The Key to New Metals

CONTRARY TO EXPECTATIONS, the sequence of development of metals has not depended entirely on abundance but also on the stability of the oxides and the melting points of the metals. Free energies of oxide formation, listed in the table (right) are an approximate measure of the difficulty of reducing oxide to metal. (More stable oxides have higher negative free energy values.) Also important is the tendency to dissolve gases at high temperatures.

Older metals are those of low oxide stability and, relatively low melting point. Early metallurgists could reduce the group with carbon and the metals could be handled and purified in molten form.

The steel additive group is also readily reduced by carbon but those more recently obtained in pure form, and those still presenting difficulties, are high melting or embrittled by solution of trace gases. Development had to wait on new techniques, new facilities.

Aluminum and magnesium mark the departure from carbon smelting. Commercial production requires a stronger reducing agent or fused salt electrolysis. Why? Compare their free energies with earlier metals.

New metals are in two categories: Those only recently available because of scarcity (thallium, indium, rhenium, hafnium); and those whose physical properties require new production techniques. The table indicates clearly that most of the potentially important new metals have such high oxide stabilities that carbon reduction is no longer practical. Further, the higher melting points of the group and a common tendency to dissolve gases will require special techniques for refining. As these metals become more important, the tools of extractive metallurgy must become drastically changed.

TABLE 1
Free Energies and Melting Points Old and New Metals

Metal	Free Energy[1] (Kilo calories)	Melting Point deg. C.
Pre 19th Century		
Copper	− 30.4	1083
Lead	− 45.3	327
Zinc	− 76.1	420
Iron	− 59.3	1535
Tin	− 62.1	232
Late 19th—Early 20th Century		
Cobalt	− 51.0	1480
Nickel	− 51.3	1455
Molybdenum	− 54.0	2620
Manganese	− 55.6	1260
Tungsten	− 60.6	3370
Vanadium	− 68	1710
Chromium	− 83.5	1615
Early 20th Century		
Aluminum	−126.0	660
Magnesium	−136.0	651
Mid 20th Century		
Thallium	− 33.1	303
Rhenium	− 45.1	3000
Indium	− 66	155
Columbium	− 84.4	1950
Tantalum	− 91.3	2996
Titanium	−106.2	1800
Zirconium	−124.0	1705
Hafnium	−126.1	1700
Lanthanum	−138.5	826
Cerium	−138.5	640
Thorium	−140	1845
Beryllium	−140	1350

(1) Free energies of oxide formation per atom of oxygen at 25 deg. C. (Leo Brewer, *Chemical Reviews*, 52 #1 Feb. 1953.)

5. Chemical applications.
6. Nuclear energy applications.

Let's see how the new metals stack up against these factors and possible applications.

Alkali Metals

This group includes lithium, sodium, potassium, rubidium, and cesium. Sodium and potassium make up 5.5% of igneous rocks and are found in enormous quantities in brines and oceanic waters. Lithium is found in spodumene and in Searles Lake brines in ample supply. Rubidium and cesium are fairly abundant but in low concentration; they are mainly obtained from lithium ores and salt brines.

The activity of these elements with oxygen and water is so pronounced that there is little likelihood of their use in metallic form under normal atmospheric conditions. Their melting points ranging from 367 deg. F. for lithium to 83 deg. F. for cesium, are also unfavorable. Lithium, the highest melting of the group and also the lightest of all metals, has received attention for possible use in aeronautical structures, but there is no present indication that its instability can be overcome. Metallic uses for sodium and potassium are even less likely.

On the other hand, applications of lithium as a minor alloying element are promising, particularly with magnesium bases. The crystal structure of these alloys changes over to cubic at 10.7% lithium with development of much higher ductility. It has also been used in lead-bearing metal in minor amounts to confer high temperature hardness, and along with magnesium or cerium to produce modular cast iron.

Non-metallurgical applications of the alkali metals, particularly of sodium and potassium, are widespread and well-known. New uses include the lithium greases which are valuable for low-temperature service, and lithium fluxes for aluminum welding. Sodium metal has been investigated in the production of titanium, and cesium metal is potentially useful in photoelectric cells and vapor rectifiers.

Thus, the general outlook for the alkali group is not favorable for large-scale industrial uses for the metals as such. The greatest fields for expansion are in (1) chemical

ZIRCONIUM FURNACES for zirconium deposition process, which was begun at the Westinghouse Atomic Power Division, produce "crystal bars" 99.9% pure. This production aisle was designed and equipped in only 14 weeks.

applications of sodium and potassium minerals and compounds, and (2) in the special alloying, electronic, and chemical applications of the individual members of the group.

Alkaline Earths

This group includes beryllium, calcium, strontium and barium. The demand for beryllium, one of the most promising of the newer metals, is already taxing the available supply. Calcium and barium, on the other hand, are plentiful but are limited in any metallurgical applications by poor corrosion resistance. Strontium also lacks corrosion resistance and is known only in low-grade deposits.

Beryllium has a favorable combination of low density (1.82), high strength, corrosion resistance, useful alloying characteristics, and important atomic energy applications. The latter fact has accelerated all phases of its production metallurgy. The original brittle characteristics of the metal have been largely eliminated as greater purity has been obtained, so that hot working is practical. Cold-working properties are not yet completely adequate.

The principal source of the metal is beryl with domestic consumption requiring importation of 90% of the requirements. There is some indication that domestic production could be increased by working pegmatite dikes for beryl along with mica and feldspar. In the past beryllium has gone principally into the production of beryllium-copper alloys which accounted for 90% of domestic consumption. These alloys are notable for good high-temperature conductivity, fatigue and wear resistance, high tensile strength, and hardness. Expanded applications of beryllium have been severely limited by the inadequate supply and to a lesser extent by the toxicity of beryllium compounds. This has stimulated development of substitute alloys, but beryllium's superior properties will probably continue to cause full exploitation of sources of supply.

Calcium, Strontium and Barium. The use of these three metals, like that of the alkali metals, is severely limited by their high reactivity toward oxygen and water. This is particularly unfortunate in the case of calcium which makes up 3.6% of igneous rocks and has favorable mechanical properties. Its strength-weight ratio (density 1.54) is higher than that of pure iron, copper, or 99½% aluminum. It is readily cast in an inert atmosphere and is easily worked, but its lack of corrosion resistance and unpromising alloying properties will prevent important applications for the metal or high-calcium alloys. Minor alloying applications are found in hardening lead, and in lead-copper bearing bronzes. The known uses for the metal in the past (principally as a reducing agent) have usually been inadequate to consume the small supply.

Barium and strontium have no important present application. No large-scale production of the metals is indicated, because of their inherent instability. However, little is known about their alloying properties.

Tri-valent Elements

Boron, Gallium, Indium and Thallium form a group of tri-valent ele-

ments which has been until recently in the rare-metal category. Boron is the only member of the group known in economic deposits. The others are byproducts of smelting and refining.

Boron is perhaps technically not a metal at all, although it has growing importance in metallurgy. It is light (2.3 density), corrosion resistant and high-melting, but it has no practical workability. Although greater purity may have a minor effect, it is probable that the poor mechanical properties are characteristic of the element, and that there is only a limited field of application for it in massive form.

In contrast, the application of boron in alloys, as coatings on other metals, and in inter-metallic compounds, is of growing importance. Most striking is the value of low-boron additions to steel in elimination or reduction of other critical additives. For example, the presence of 0.002% boron in a 0.4% carbon steel is reported to be equivalent to 0.3% manganese, 0.35% molybdenum, 0.5% chromium or 2.0% nickel in improving hardenability. The coatings of metals with boron, or boron compounds, offers promise in protecting surfaces against wear, heat and corrosion. Such coatings may either be of boron itself, or of the borides of tantalum, tungsten, vanadium, or zirconium, or of boron carbide, nitride or silicide. An important possible application of these coatings is to metals such as molybdenum which have excellent high temperature mechanical properties, but poor resistance to oxidation. Nickel base alloys with minor boron content have excellent wear resistance and are fusible; they can therefore be applied to other metals by spraying and welding.

The borides, particularly boron carbide, are extremely hard and have minor applications in massive form. More promising is the use of borides of chromium, molybdenum, titanium and zirconium, in fabricating "cermets."

Gallium. This metal, although available commercially, is sold on a gram basis. It is fairly abundant but not in any primary ores. Potential production can derive either from bauxite ores, many of which contain about 0.01% gallium, from Tri-State zinc ores, reported to average 0.005% of the metal, or from coal-ash and flue-dust. Although potential production on this continent can be of the order of 5 to 50 tons per year, no important uses for the metal are known. Its low melting point (29.8 deg. C.) and high temperature oxidation are unfavorable for its use as pure solid or liquid. No important alloys have been developed, nor are any of its compounds of present technical interest. Possible fields of application may exist in electronics, phosphors and low-melting alloys.

Indium is also a trace metal with no important primary sources. It is found in zinc, lead, tin, and tungsten ores, and is produced commercially from zinc and lead smelters and refineries. Present production rates are measured in ounces. The metal lacks strength; therefore there are no structural uses in pure form, or as an alloy base. Its softness and ductility have lead to minor applications in motor-bearings, but with no significant improvements over tin. It has application as a solid lubricant particularly for coatings in deep-drawing dies, and has shown some promise as a minor constituent in lead and lead-tin alloys. Its compounds may have electrical applications through their photo-electric and fluorescent properties.

Thallium is also a byproduct metal obtained in zinc, cadmium, sulphuric acid and arsenic production. The supply is small and there is no present commercial application of the metal. It has been reported to confer hardness and corrosion resistance on lead, and can be co-plated with lead on iron, steel or brass. Its alloys with silver resist corrosion and sulphide tarnishing. Present production goes principally to chemicals where rodent poisons are the main application. Thallium bromo-iodide crystals have a potential use as lenses for infra-red signalling. Although fairly large reserves of thallium are available in the arsenical gold ores at Mercur, Utah, present indications do not favor an important role for the metal.

"CERMETS" What Are They?

As jets, turbines, and rockets push engine operating temperatures higher, the number of useful metals and alloys for construction becomes limited. The solution may lie in:

Ceramics like lithium silico-aluminate which is non-oxidizable, resists thermal shock but is fragile cold.

Carbides of tantalum, columbium, titanium and tungsten or borides of chromium, molybdenum, titanium, or zirconium, also fragile when cold and requiring powder metallurgy techniques.

Cermets which are composites of metallic alloys and ceramics. Examples: alumina with iron or chromium; zircon with cobalt, nickel, chromium and copper; titanium carbide with nickel, cobolt and molybdenum. These have intermediate properties; better strength than ceramics alone, better corrosion resistance than metals alone.

Group Four

The most active developments in today's metallurgy are centered in Group Four of the periodic table, particularly in titanium (considered elsewhere in this issue) and in zirconium. The group as a whole illustrates the present and future problems in the field. Silicon, by far the most abundant of the solid elements, has poor mechanical properties. While this is probably inherent, the element has such a favorable combination of lightness, corrosion resistance, high melting point and ease of production as to challenge the ingenuity of metallurgists in adapting it to structural uses. Germanium, until recently a laboratory curiosity, selling for $10 a gram, attained a production of 5-6,000 lb. in 1951, principally for electronic applications.

In the other sub-group, titanium and zirconium, both relatively abundant with excellent metallic properties, present large technical problems in production and purification which must be solved if their full potentialities are to be realized. Cerium, one of the more abundant rare earths, already has important alloying uses. Thorium, with good metallic properties and alloying possibilities is handicapped by limited supply and by atomic energy requirements. Hafnium, with its valuable metallic characteristics, will always be limited to a byproduct role in zirconium production.

Silicon, as already indicated, has many useful properties but it cannot be worked. Although attempts have been made to obtain ductility and there is some evidence of high

temperature plasticity, the goal of practical workability appears out of reach in view of the element's crystal structure. On the other hand, large tonnages of ferro-silicon are consumed annually in steel ingots and castings, and in the manufacture of high-silicon steel for electrical equipment and springs. Newly developed aluminum-silicon alloys are also of potential importance.

Recent applications of silicon are in the protection of other metals, by means of coatings of silicon metals or silicides. This is accomplished by the older Ihrigizing process, or by more recent vapor-phase reactions using silicon tetrachloride and hydrogen. Such coatings, like those of boron, have good corrosion and heat resistance. The process is of potential importance in protecting molybdenum, but is of less value for tungsten and tantalum.

Germanium. This element, like silicon, is a metalloid with a diamond-type lattice. In consequence, no important structural applications for the pure metal are to be expected. Little is known about alloying possibilities except that the eutectic with gold has been suggested for dental castings.

Major interest in germanium and the stimulus for the recent increase in its production are based on the rectifying and photo-electric properties of the metal crystals. Germanium diodes, which can replace vacuum tube diodes in many applications, are in production at the rate of almost 10-million per year, while the triodes, or transistors, are near commercial application. Other potential uses are: as rectifiers to compete with selenium or copper oxide; in compound form as phosphors; and for special optical purposes. Present demand could result in a consumption of 10 to 20,000 lb. of germanium per year, while potential new uses could increase this by a factor of ten.

The present domestic supply comes almost entirely from Tri-State zinc ores in the fume products from salt sintering of zinc concentrates. British production is based on coal flue dust with some recovery from germanium minerals. Recent reports describe the occurrence of the minerals germanite and renierite in significant quantities in African base metal ores, and also of the possibility of concentration of these minerals. Thus an increased demand can stimulate production from these sources. On the other hand, the present high price of germanium ($340 per lb.) has led to intensive investigation of other materials with semi-conductive properties such as silicon metal, cadmium sulphide, and inter-metallic compounds. Success in this direction will conceivably affect the future of germanium production.

Zirconium. The pace of zirconium metallurgy is best illustrated by its nominal costs per pound of over $200 in 1948 and $7 for the crude in 1953. The incentive has been its unique adaption to water-cooled nuclear reactors. It is lighter than steel, remarkably corrosion resistant, has excellent mechanical properties and low neutron absorption. Its tonnage production in ingots of 99.9% purity by Westinghouse (see photo) represents a notable achievement in metallurgy.

The raw materials for zirconium are zircon-bearing sands from Florida, India and Australia, or Brazilian baddeleyite. Zircon concentrates are converted to the chloride which yields sponge metal by reduction with magnesium. Sponge is converted to crystal bar by successive conversion to the iodide and its decomposition on a heated zirconium filament. Arc furnace melting of the crystal bar yields ingots which are readily fabricated. Present production of zirconium is almost entirely taken up in nuclear applications, although small quantities have recently become available commercially.

From what metallurgists now know about its properties it will have an important but limited tonnage application in industry. The principal factor determining its use will be the extent to which improved large-scale production methods can lower its price. Main uses are expected where its unique combination of strength and corrosion resistance is required. Zirconium does not appear to have a promising role in general structural applications because its strength-weight ratio is close to that of strong magnesium, aluminum and titanium alloys, while its probable cost in the immediate future will certainly be higher than that of any of these materials. While its full alloying possibilities are not known, it already is important as an additive for steel and magnesium. In steel making, it is used as a deoxidizer and grain refiner; it is added to cast iron to improve strength and workability. It is said to have a greater effect on magnesium for improving workability, strength and toughness than any other metal. Added to magnesium with zinc it improves casting qualities, competing in this case with the rare earths.

Considerable tonnage of zirconium minerals and compounds has long been used in refractories. Research and development is now in progress on the carbide and boride for high temperature stress and corrosion resistance, either alone or in "cermets."

Hafnium. The present outlook for hafnium is limited both by its scarcity and by its probable high production cost. The element is known only in association with zirconium minerals, usually representing less than 2% of the zirconium content. It can be separated from zirconium by recently developed methods, but its purification and reduction to metal are both complicated and expensive. It has good mechanical properties and corrosion resistance, but it will have to compete with titanium and zirconium. Its future role may depend more on electronic applications and on its carbide, which has an extremely high melting point.

Rare Earths. Long known to occur in monazite sands, this group of 18 elements has until recently found no important metallurgical applications. Cerium, lanthanum and thorium are the only members of the group available in significant amount. Although the group as a whole is no less abundant than copper or lead, the similar physical and chemical properties of the mixed metals and their compounds had long defied practical separation. Recently developed ion exchange and solvent extraction processes are now reported to be yielding small amounts of the relatively pure metals for the first time. Progress in their development is also stimulated by the discovery of substantial deposits of bastnasite—a rare earth fluocarbonate—in New Mexico and California, by possible uses for thorium in atomic energy application, and by important alloying developments with cerium and lanthanum.

Thorium has a high melting point, excellent corrosion resistance and good alloying possibilities in both ferrous and non-fer-

rous applications. Its commercial future is uncertain because known reserves of monazite would be expensive to process for the rare earths alone and atomic energy requirements may interfere with other uses.

Cerium and lanthanum have application chiefly in the form of mischmetal which contains 50% cerium and 45.5% lanthanum. Used along with zinc, mischmetal increases the strength of magnesium castings at moderately high temperatures. Used with cast steels, marked improvements are obtained in ductility, strength, fluidity, and other important properties. Improved ductility is also obtained in certain stainless steels, and improved hot workability in others. Cerium alone is used in titanium stainless steels to improve surface properties and hot workability. While fused salt electrolysis is necessary for the reduction of cerium and lanthanum, the low melting points of both of these should permit a relatively low production cost if a wider demand develops.

Columbium, tantalum, and **rhenium.** The three elements considered in this group possess actual, or potentially useful metallic properties, but their known reserves are completely inadequate for any extensive applications.

Columbium has been recovered as columbite from the tin gravels in Nigeria. The exhaustion of richer workings and of tailings piles has seriously reduced output. Although lower grade reserves are known in Nigeria, these may not be profitable with present metal prices. Other minor sources are available in Africa, South America, and Norway, while potential undeveloped reserves have recently been reported in Ontario and in Arkansas bauxite.

The major use for columbium is in high-temperature alloy steel for jet engines, turbines and rocket components, where it has the unique ability to prevent intergranular carbide corrosion. Until recently the element has been regarded as indispensable for this application, but the demand for it may be reduced by the present availability of low-carbon ferrochrome.

Tantalum is usually recovered from mixed columbite-tantalite concentrates. Although it also has a carbon-fixing capacity in alloy steels, its main applications are based on its excellent corrosion resistance. This has led to its minor use in electrical parts, surgical devices and chemical equipment. The availability of zirconium is expected to reduce the demand for tantalum. Tantalum carbide has shown considerable promise in cutting tools.

Rhenium will probably always be a byproduct of molybdenum production if any demand for it develops. It is known only in fractional percentages in molybdenite. Both its melting point and density are exceptionally high and its resistance to oxidation resembles that of tungsten. It was used to a minor extent in Germany during World War II, as a platinum substitute.

General Evaluation of the Newer Metals

The main purpose of this evaluation is to attempt to assess the probable future importance of the newer metals whose individual properties have been outlined. The emphasis will be primarily on metallurgical rather than chemical applications. While there is a certain element of speculation involved, the broad outline, if not the details, are apparent.

The chart on page 94 shows factors which should determine the eventual utilization of these newer metals.

1. The lack of resistance of the alkali and alkaline earth metals as a group to oxidation is too pronounced to permit their use in massive form or as alloy bases. Only in the event of a completely unexpected method of protection could any of them be important structurally. If such protection were to be developed, calcium metal might seriously challenge the other light metals because of its good mechanical properties, very low density and abundance.

2. Silicon, boron, germanium and gallium likewise appear to have no potential use structurally because of inherent lack of workability in the case of the first three, and of low melting point in the case of gallium. The future of silicon and boron in metallurgy lies in alloying, and in oxidation- and abrasion-resistance compounds and coatings. Germanium and silicon will be useful in small quantities because of their semiconductive applications. Gallium at present shows no important future.

3. Lack of known reserves is a further limitation for many of the newer metals. If a demand were to develop, the future of hafnium would be completely determined by the eventual production rate of zirconium metal, and that of rhenium by molybdenum production. Likewise thallium, indium, gallium, and germanium, to a large extent, will be limited in availability by the production rate of their host metals.

The dominating characteristics of the potentially useful new metals, including titanium and zirconium, are such as to suggest inherently higher relative prices than those for the well-established older metals. Only in the case of titanium is there reason to expect tonnage production approaching those of the copper-lead-zinc group, and this only if its price is sufficiently reduced by technological improvements to enable it to make serious inroads into the stainless steel market. Zirconium, with heavy competition from titanium in most applications, should reach only a moderate tonnage role in alloying and corrosion resistance. Columbium, tantalum, beryllium, hafnium, and rhenium are seriously restricted by supply limitations as well as difficult technology, with a still lower place in the production series indicated. Of the rare earths, with thorium probably unavailable because of atomic energy requirements, only cerium and lanthanum can have significant production with their exact places still uncertain due to insufficient information on their metallurgy.

The Overall Picture

In the overall picture, according to present indications, the new metals considered here should be regarded as a vital addition to the metal arsenal but in relatively minor tonnages. Their major influence should not be as strongly felt in mining as the potential expansion in the metals such as steel, aluminum, and titanium. But, they will continue to present new problems in concentration, in metal extraction and refining, and in metal and alloy development.

IRON ORE — "A New Era . . . .

These Major Projects Have Been Undertaken

Company	Project	Investment	Capacity	Status
	LAKE SUPERIOR IRON COUNTRY			
Erie Mining Co., Minn.	Pilot taconite plant and mine	$2-million	200,000 tons/yr.	Work completed
	Ultimate plant	$298-million	Up to 10-million tons/yr.	Waiting to build
Reserve Mining Co., Minn.	Preliminary plant, mine	$7½-million	300,000 tons/yr.	In operation
	Eight- and 12-sec. plant	$160-million	3,750,000 tons/yr. (12 sec.)	Ready 1957
Oliver Iron, Minn.	Pilot taconite plant and mine	$17-20-million	500,000 tons/yr.	To start in 1953
	Experimental nodulizing plant		500,000 tons/yr.	In operation
	Experimental sintering plant		500,000 tons/yr.	In operation
Cleveland-Cliffs, Ford	Humboldt plant and mine, Mich.	$10-million	400,000 tons/yr. (2 units)	2d unit ready, 1955
Cleveland-Cliffs	Republic plant and mine, Mich.		1 unit-200,000 tons/yr. 7 units—1½-million tons/yr.	Preliminary planning
Oliver Iron, Two Harbors	Screening, sintering plant	$60-million		Engineering planning
Oliver Iron, Mesabi	Plummer mine and plant		1¼-million tons conc./yr.	Ship 1954
Pickands, Mather, Mich.	Peterson mine, opening			Full production, 1955
Jones & Laughlin, Mich.	Tracy mine, opening		1-million tons/yr.	Start in 1954
M. A. Hanna Co., Mich.	Cannon mine, opening		800,000 tons/yr.	Start in 1954
	U.S. OUTSIDE LAKE SUPERIOR IRON COUNTRY			
Jones & Laughlin, N. Y.	Benson Mines—Martite mill	$5-million	300,000 tons/year	Completed
	More sintering capacity	$4.4-million	300,000 tons/year	
Republic Steel Corp., N. Y.	Fisher Hill, Martite recovery	$300,000	Recover 75% of iron now lost	
Kaiser Steel Corp., Calif.	Eagle Mountain mine and mill	$2½-million	2.16-million tons/yr.	Complete 1953
Bethlehem Steel Co., Pa.	Grace mine and benefic. plant		Over 1½-million tons/yr.	Complete 1960
	Warwick mine, to be opened		Half-million tons conc./yr.	
Tennessee Coal Iron, Ala.	Mechanizing. See page 168			
Woodward Iron Co., Ala.	Mechanizing. See page 168			
	CANADA			
Iron Ore Co. of Canada	To open Labrador-Quebec deposits	$243-million	10-million tons/yr.	10-million tons in 1956
Steep Rock Iron Mines, Ont.	New mine, "B" zone	$5-million	1¼-million tons/yr.	Ship in 1953
	New mine "A" zone		2-million tons/yr.	Ship in 1955
Inland Steel Co., Ont.	New pit, Steep Rock "C" zone	$50-million	3-million tons/yr.	Ship in 1960
Algoma Ore Properties, Ont.	Increasing output	$1-million	1,450,000 tons planned	Progressing
Dominion Ore & Steel Co.	Raise Wabana output, N'fdl'nd			Mechanizing
Bethlehem Mines Co., Ont.	Marmora mine and benefic. plant		⅓-million tons agglom. conc.	Completed in 1955
Quebec Iron & Titanium Corp.	Expansion to 5 furnaces		1500 tons/24 hr. Ore 40% iron	Completed

Steel Demand Sets Goal . . .

CAUSES OF THE CHANGING SITUATION are:

1. **Demand for steel** is seen increasing with every successive decade to supply needs of growing population and the rising level of industrial activity. Here, a population of 171 million is estimated for 1960, 190 million for 1970, and 211 million for 1980. The basic industrial activity is likewise seen growing at a rate that requires increasing quantities of metals to maintain.

2. **Steel capacity**[1] in the United States was 104.23-million tons in 1951, ample for current requirements. By 1960 it is estimated that it will have risen to 125-million tons, and to 137.5-million and 150-million, successively by 1970 and 1980. Likewise abroad, in countries with established steel industries, the desire exists to create the facilities required to expand production to new high levels.

3. **Iron ore supply** must meet the goal established

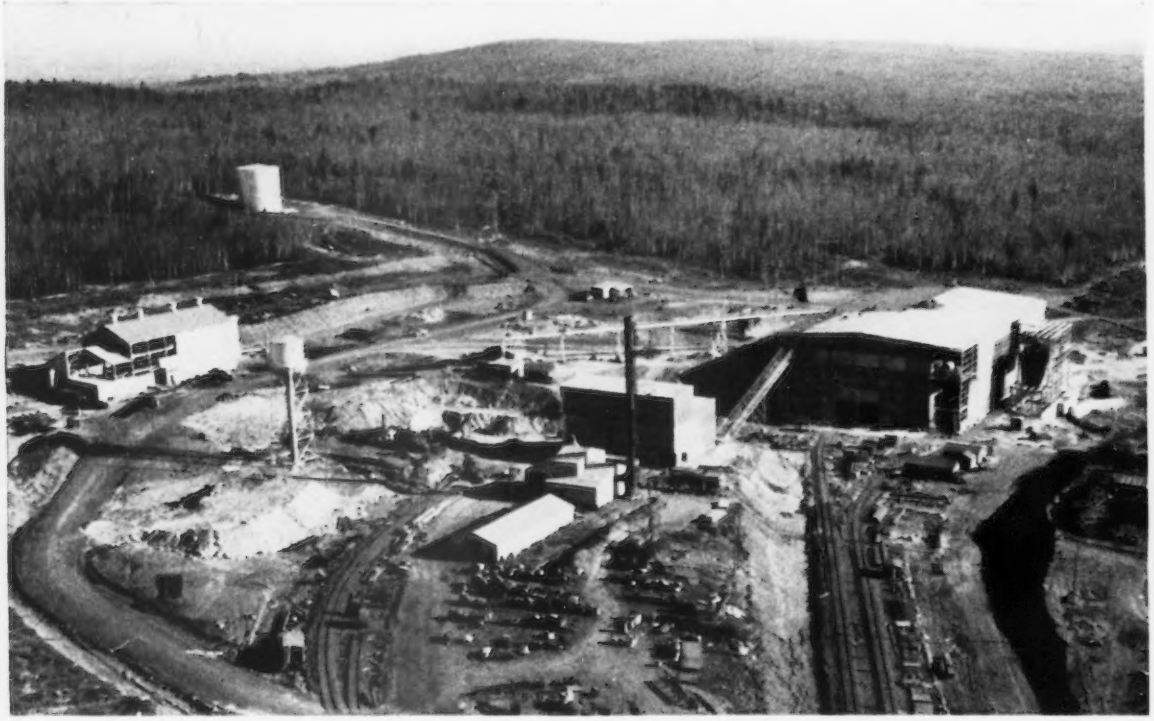
to Meet the New Era's Demand for Steel

Company	Project	Investment	Capacity	Status
		LATIN AMERICA		
Iron Mines Co. of Venezuela	El Pao-Increasing production	$35-million	Increasing to 3-million tons/yr.	In full swing
Orinoco Mining Co., Venezuela	Cerro Bolivar-Developing, equipping			Ship in 1954
Marcona Mining Co., Peru	Developing deposits, shipping	$6-million spent	2-million tons/yr.	Nearing regular shipments
Bethlehem Steel Co., Chile	El Romeral mine. Developing and equipping			
Hojalata y Lamina, Mexico	Sponge iron from Durango lump ore	$250,000 (est.)	10,000 tons per year	In operation
		EUROPE		
Grängesberg Co. and Swedish State	Convert Kiirunavaara pit to underground, increase output	$100-million including Malmberget and Narvik below.	Present rate, 9-million metric tons/yr. Planned rate, 15-million metric tons/yr.	
	Malmberget mine — increase output, complete magnetic plant, and provide pelletizing plant. Also to improve Narvik port.		Present rate, 3½-million metric tons/yr. from 2.7-million tons in 1948. Rate in 1955 is to be 5-million tons/yr.	
Various Steel Plants Sweden	Several Wiberg-Soderfors furnaces and 2 tunnel kilns for making sponge iron direct from ores		120,000 tons of sponge per yr. Including existing output	Building or planned
Sydvaranger Co., Norway	Rehabilitation of mine	$18-million	Present rate, 850,000 tons/yr.	Completed
Otanmaki Mine, Finland	Concentrator	$7-million	175,000 tons iron conc. per yr.	
Austrian Alpine Montan Co.	Raise output, Erzberg and Radmer mines	$9-million since 1949	2,700,000 tons/yr.	
French Mines, Lorraine	Modernization	$143-million in addition to $73-million since 1945	53-million tons by 1958	Moving rapidly
Mines in Yugoslavia	To supply ore to new steel industry		2½-million tons ore/yr.	
		AFRICA		
Liberia Mining Co., Africa	Bomi Hills mine and port		1½-million tons	Capacity output, 1953
Dominion Iron & Steel Co., S. Africa	Sponge iron by Krupp-Renn process	$4.2-million	1 70,000-ton kiln	Start making iron 1953

. . . Ore Supply Must Meet It

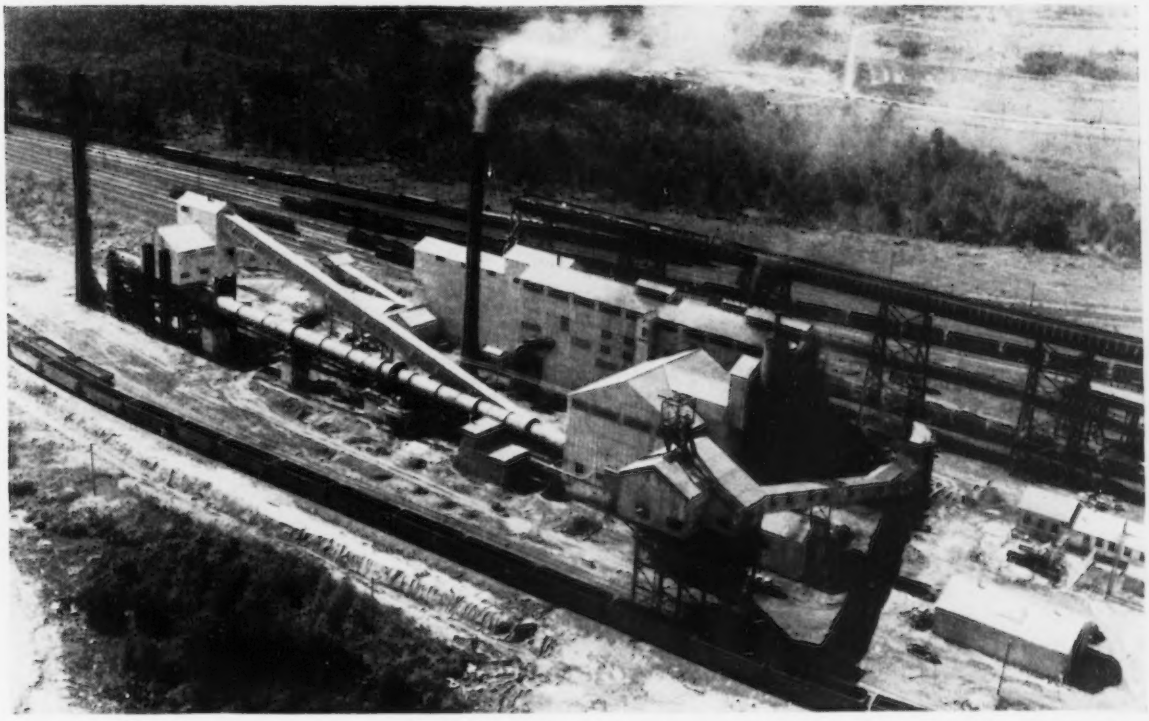
by prospective steel demand. The supply in 1960, 1970 and 1980 is estimated[1] at 134-million, 145-million and 157-million tons respectively. With the decline in tonnage of direct-shipping ores from the Mesabi, long the mainstay of the steel industry in the United States, the poorer ores of the range that can be beneficiated with comparative ease will have an important part in making up the deficiency (p. 104). For the long term it is recognized that needed ore must come from two sources: High-grade concentrates from taconite beneficiation and imported high-grade ores. These materials, plus the concentrates made from the poorer Lake ores, will come from projects tabulated above. Outstanding projects are dealt with in pages following.

[1] "Iron Ore Supply—A New Appraisal of the Outlook." W. Stuart Harrison, vice president, Cleveland Cliffs Iron Co. *E & M J*, June, 1953. Pp. 81-83.



NEWEST OF TACONITE PLANTS, the Pilotac plant of U. S. Steel's Oliver Iron Mining Division north of Mountain Iron, on Mesabi Range, is to be put in operation this summer. A pilot plant, its annual capacity is 500,000 tons.

STRIPPED TO EXPOSE THE TACONITE FORMATION for mining by power shovels, this tract is being developed as an experimental open pit to supply ore to Pilotac concentrator (shown above) one mile away.



AGGLOMERATION of taconite concentrates made at Pilotac plant will be worked out in this experimental nodulizing and sintering plant near Virginia, Minn. Latter has been treating iron ore fines from nearby mines.

Five Major Projects Under Way In Iron Country

WHEN OLIVER IRON MINING'S new half-million ton pilot plant for beneficiating taconite produced its first carload of concentrates on June 9, it brought to three the number of taconite beneficiation projects that have been initiated in Minnesota. This plant is two miles north of Mountain Iron, on the Mesabi. Construction is complete, the picture opposite, like that of the mine, having been taken somewhat before this stage was reached. Late summer should see the plant and mine in full operation.

The other two projects are Erie Mining Co.'s 200,000-ton pilot plant at Aurora, and Reserve Mining Co.'s 300,000-ton preliminary section at Babbitt. The last is the forerunner of eight similar sections of a unit which the Reserve company expects to install by 1955 near Bea-

Iron Ore for the Future

DR. E. W. DAVIS

Director, Mines Experiment Station, Minneapolis, Minn.

A REVOLUTION is underway in the Lake Superior district. A new group of active, technically-trained young men is moving in. These men do not believe that the Iron Country is "running out of ore." They believe that it is simply "running out" of the type of ore that has been mined in such constantly increasing quantities over the past 50 years. It is now time to learn how to use a new type.

It is apparent now that the iron-producing industry of the Lake Superior district is going to continue to ship enormous quantities of iron ore to the blast furnaces in spite of the approaching exhaustion of its direct-shipping ores and in spite of the discovery of wonderful new high-grade ore deposits in foreign countries. It is comforting that this nation is not to become dependent upon outside sources for such a vital mineral as iron ore. It is now clear that we can secure for generations to come all the ore we need from the Lake Superior iron formation. Economics will determine how much we secure from one source or another but the new Lake Superior ore now beginning to be produced is going to be hard to beat.

This new ore is not just another raw material to be shipped and used as it is found. It is a concentrated product for blast-furnace smelting. Hundreds of thousands of tons of this new material—pelletized taconite concentrate—have already been shipped and tested in the large modern furnaces of the steel industry. While the pellet cost will be high, the savings in smelting and steel production will largely offset the excess amount.

The organizations that are doing this will spend a billion dollars on taconite plants, mines, railroads, and harbors in the next decade. Their pilot plants will continue to produce while the big commercial plants are being built. In this way, the mines will be developed for large production by the time the big commercial plants are completed and trained operating crews will be ready to take over.

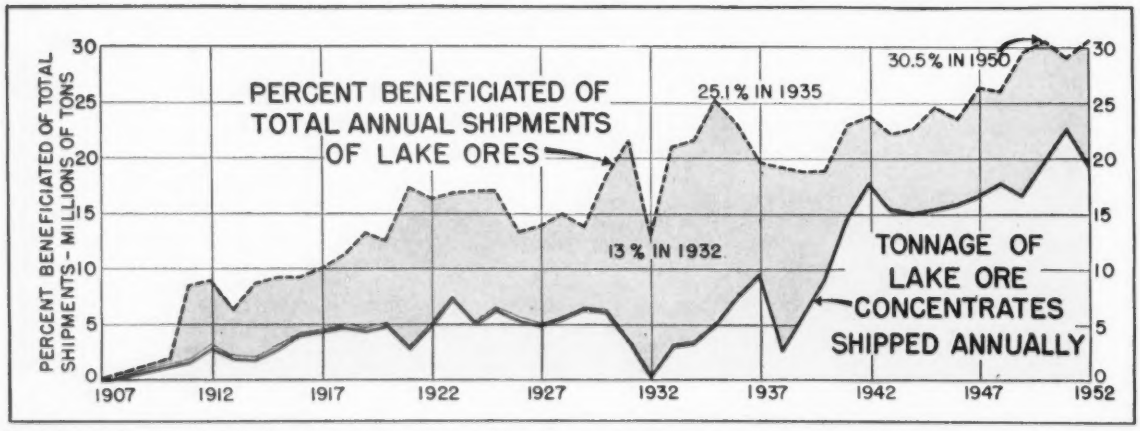
The Iron Country is full of activity and enthusiasm again. New capital is being invested, new people are moving in, new towns are being built, and now,there is plenty of iron ore for the future.

Two jasper projects ➡

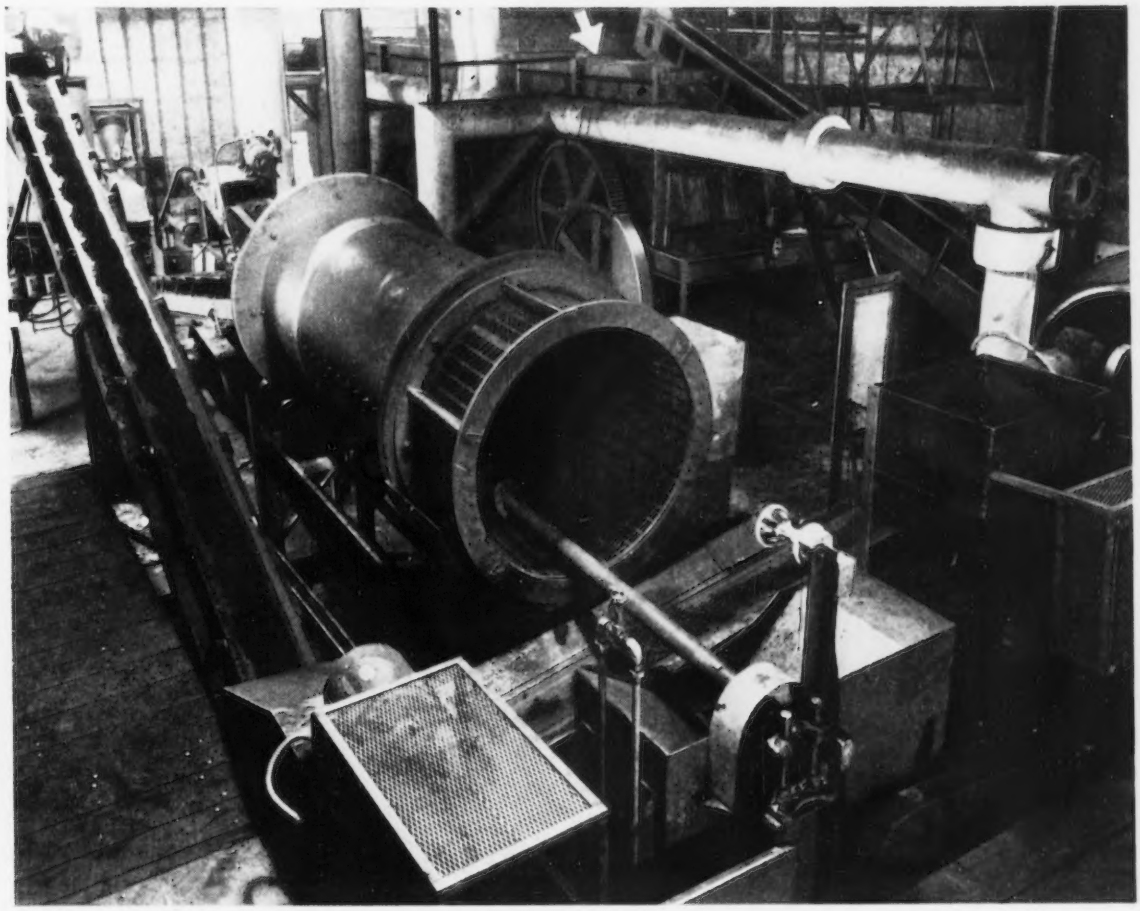
IRON-BEARING JASPER of Michigan is to be beneficiated in two plants on Marquette Range. Here the first 200,000-ton unit of a seven-unit plant for the Republic mine has been sketched by architect. A Cleveland-Cliffs project.

HUMBOLDT MINE'S jasper beneficiation plant now being provided by Cleveland-Cliffs Iron Co. and Ford Motor Co. will have two 200,000-ton units. Here first is under erection, as seen in June. Mill building, center. Office-shop, left.

Plants for Treating Leaner Lake Ores Grow in Number



MANY NEW TYPES OF ORE-DRESSING EQUIPMENT have been tested and some adopted with good results, as tonnage of Lake ore beneficiated has increased. Starting with screens, log washers and classifiers of old standard Mesabi flowsheet, iron-ore dressing practice has seen its outstanding development in sink-and-float separation with ferrosilicon medium. High-density plants, cyclone plants, and spiral installations are currently in limelight. Jigging finds various users. Data for above graphs have been taken from Mining Directory of Minnesota, 1953.



MACHINE FOR HEAT-HARDENING taconite pellets that has been developed by Allis-Chalmers Manufacturing Co. and Arthur G. McKee Co. is seen. Traveling grate is indicated by arrow. See story, p. 106.

ver Bay, 47 miles from Babbitt on the shore of Lake Superior, as well as of the four sections of the additional half unit which will be installed two years later. Details of harbor construction near Beaver Bay, of the housing facilities there and at Babbitt, as well as of the railroad between the two points were given in *E&MJ*, Nov., 1952, pages 72-79.

Magnetic separation features the concentration flowsheet in each of the three cases. Little more than this can be said at this stage about any one of the flowsheets specifically. The flowsheet and accompanying data, which were published without reference to any specific plant in *E&MJ*, July, 1952, pages 72-75, are more informative about features of current treatment of taconite than anything released for publication to date by the respective operators.

Like Oliver's new plant, Erie's plant at Aurora is a pilot plant, equipped with commercial size equipment. In the five years it has been operating the company has obtained extensive data with this full-scale equipment that should be useful in designing and operating its ultimate full-scale 10½-million-ton plant, or the half of the plant that is likely to be undertaken first.

Iron From Jasper

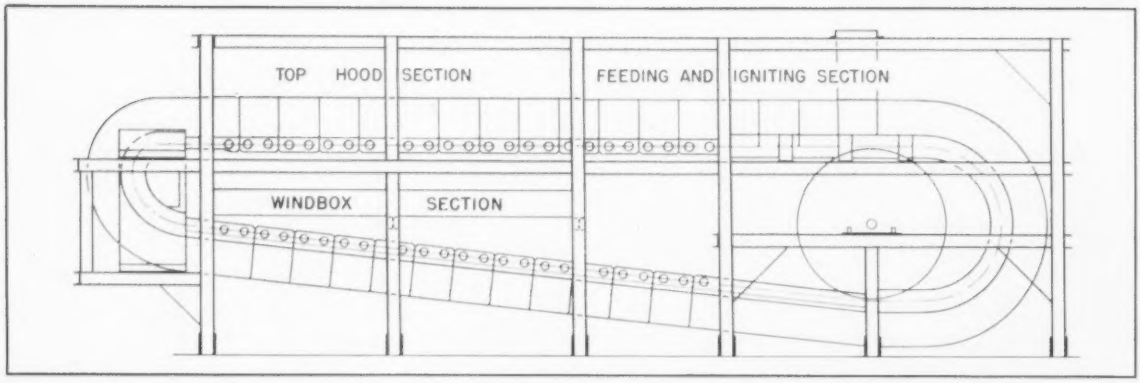
Two projects are underway in Michigan for recovering iron from jasper. One is the 400,000-ton project of Humboldt Mining Co., in which Cleveland-Cliffs Iron Co. and Ford Motor Co. participate. The enterprise was described in *E&MJ*, Feb., 1953, pages 128-130. Since then a change has been made in the flotation process in the flowsheet. An oleic acid float is to be used, giving a neutral pH of 7.

The other project based on jasper is that of the Republic mine of Cleveland-Cliffs Iron Co. in the same region. Plans are being drawn for the first unit, of 200,000 tons capacity. The ultimate plant will have seven units, of a capacity totaling 1½-million tons. See pictures opposite.

A Process for Non-Magnetic Taconites

Development of a so-called reduction - oxidation process for treating non-magnetic taconites was announced in May by the Battelle Memorial Institute, Columbus, Ohio, as the outcome of research in their laboratories

Agglomerating the concentrates ➡



DWIGHT-LLOYD taconite processing machine, here sketched, is now under development by Sintering Machinery Corporation, of Netcong, N. J.

sponsored by a group of ten prominent producers of iron ore. This work was part of a project that had been under way for 10 years for developing processes for concentrating Mesabi taconites. The feasibility of the process technically is said to have been demonstrated in a laboratory pilot plant which included a 2-ft. dia. shaft furnace capable of handling 600 lb. of ore per hr.

Magnetic roasting followed by magnetic separation can be used with good recoveries for beneficiating non-magnetic iron ores of widely varying analysis, but the cost of furnishing the necessary heat has always been too high. The new reduction-oxidation process is said to take less heat at the outset, and to recover it and use it over. A gaseous fuel containing hydrogen and CO or the latter alone has been found best for accomplishing the reduction. Claim is made that 92-96% of the iron, in magnetic form, can be recovered and that the cost of grinding the processed ore has been reduced. A wide variety of taconites can be treated, it is said.

Agglomeration Final Step for Taconite

Great interest centers in the agglomeration of taconite concentrates and its cost, with a minimum of information forthcoming from the companies who are wrestling with the difficulties involved. Two equipment manufacturers have taken the problem in hand on their own account. Each has developed equipment which is dealt with briefly in the following:

Traveling Grate for Heat-Hardening

Tests for the heat-hardening of taconite pellets have been under way since the fall of 1952 in the Allis-Chalmers pilot plant at Carrolville, Wis. This pioneer project, undertaken in cooperation with Arthur G. McKee Co., was set up to obtain data and operating experience using a traveling grate for hardening pellets before shipment to the blast furnace. In the center of the picture of this machine on page 105, "green" pellets are seen leaving the pelletizing drum. Exhaust heat from the traveling grate in the background (indicated by arrow) is utilized in the preliminary drying drum at the extreme right. An interim report issued after the first few months of test, showed that approximately 650,000 Btu of heat per short ton was required in the pilot plant, and that commercial units of 1,500 to 2,000 tons per day will soon be possible.

A Dwight-Lloyd Machine for Pellets

Sintering Machinery Corporation, designers and builders of Dwight-Lloyd sintering equipment, are reported to be cooperating with a number of producers and laboratories in the Iron Country and elsewhere in the design of equipment for treating pelletized taconite and other ferrous ores.

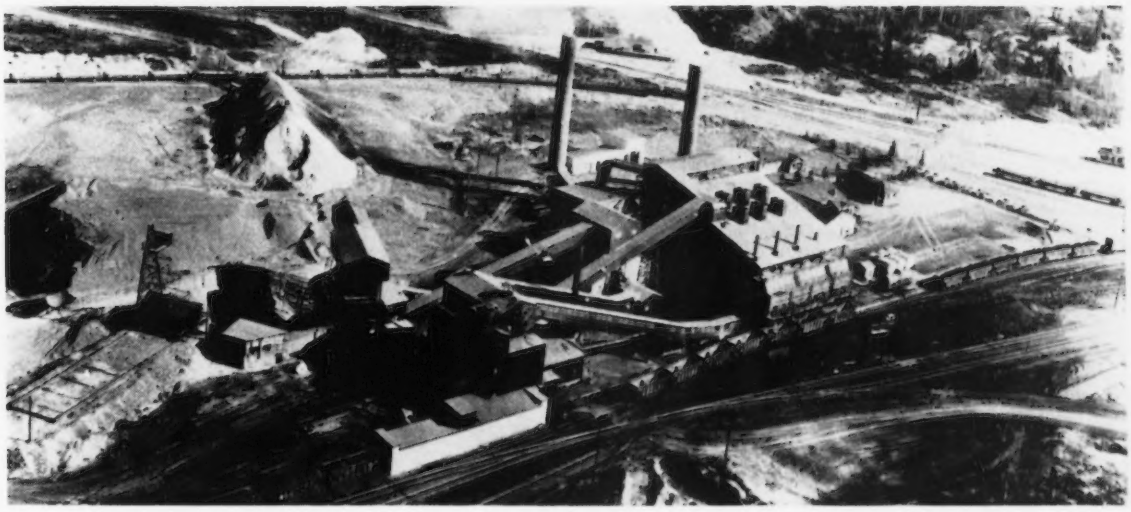
For this purpose, the conventional sintering machine has been modified generally as shown in the accompanying drawing to permit operation with a bed depth three to five times that employed in the customary sintering process. In addition, use of the Rowen windbox seal has been extended to the upper pallet seal surfaces for purposes of up-and-down draft, pressure and suction recycling of atmospheres to provide maximum heat recuperation.

In essence what is being sought is an increased efficiency in agglomeration through a modified sintering process wherein fuel costs are reduced to something approximately that reported to be attained in the shaft-furnace-type operation. With the apparent inherent advantages of a quiescent operation resulting in a minimum of abrading of unprocessed pellets and the relative simplicity of mechanical operation and control, including a completely free discharge of processed pellets, this modified pellet-sintering process seeks a more efficient utilization of necessary fuels both as to external losses and internal process requirements.

While investigations along these lines are proceeding concurrently, results thus far have neither been correlated nor announced.

Iron by Direct Reduction

Interest in the Krupp-Renn process for treating low-grade siliceous iron ores to obtain their iron by reduction in a rotary kiln is on the increase. For this and other projects see World Mine Expansion Section, page 192.



ALGOMA ORE PROPERTIES, LTD., in Ontario, is boosting its output of 1.15-million tons of sinter per year to 1.45-million in this plant, which treats the carbonate siderite ore from its New Helen mine. Cost $1-million.

Labrador-Quebec–Another Major Source of Iron Ore Supply

WHILE THE LARGE-SCALE PROJECTS for obtaining iron from taconite and jasper cited on pages 100-106 are proceding toward ultimate completion, any deficiency in U. S. ore supply resulting from depletion of direct-shipping domestic ores will be made up largely by importing foreign ores and by stepping up the concentration of the leaner ores (page 104).

Work is currently under way to bring the great iron ore resources of Labrador and Quebec into production; to increase output in the Steep Rock area and in the Algoma district, Ontario, also at the Wabana mine in Newfoundland; as well as to make and develop new finds, as in southern Ontario and British Columbia. The total activity is great.

The Great Labrador Project. Iron Ore Co. of Canada, in which six U. S. and 3 Canadian steel companies are participating to open and work the deposits disclosed in the Ungava Trough by Hollinger-Hanna Ltd.'s exploration, is pushing development of this enterprise with several contractors. Despite difficulties with high labor turnover and rising costs, the management expects to ship 2-million tons of ore in 1954 and 10-million in 1956. Production beyond this point must wait on construction of the St. Lawrence Seaway. Reserves are still put at 418-million tons of proved ore, though probably much larger. Money required is put at $243-million.

Work is under way on the railroad terminal, dumper and ore dock at Seven Islands, which was 50% complete June 1, also on the 358-mile railroad. Clearing is 100% complete, grading 60%, and rails are laid to Mile 135 from Seven Islands. The two power plants should be ready in 1954.

Construction material, equipment and supplies are now being shipped to Mile 135 by rail, to be moved further by other means as required. Track laying was resumed in June. Mining equipment, including nine 30-cu. yd. trucks, were driven in during the past winter and stripping can now begin.

In Canada's Lake Superior Iron Country

Steep Rock Iron Mines' initial promise of important tonnages is gradually being made good as new evidence is disclosed. The Errington pit on "B" orebody, first mine to be opened in the unwatered lake bed, will cease producing by the end of 1953, after having yielded over 8¼-million tons of ore. Its annual output will be replaced by ore from the underground mine being opened on the same deposit. Supplementing this will be a sufficient amount from the new Hogarth open pit on the "A" zone, now being stripped by suction dredging, to give a total output from the two mines of 3½-million tons a year. Meanwhile, drilling has shown ore to exist in the gap between "A" and "B" orebodies (the "G" orebody). Its development is planned.

Adding to the district output will be the operations of Inland Steel's Caland Ore Co. on the "C" orebody in the Falls Bay area, where the steel company plans to spend $50-million to produce 3-million tons per year. Inland's drilling has proved 50-million tons of high-grade ore, with as much more of possible ore.

Magnetic anomalies suggest that water in the Southeast and West arms of the lake likewise hide deposits. An addition ($2½-million) is being made to the Port Arthur ore dock and a $2-million block-signal system is being installed by Canadian National to double shipments by 1955.

Present investment by Steep

Rock Iron Mines is $32 million. Ultimately, it will be about $11 per ton of 5½-million-ton annual capacity.

Expansion in Algoma District. Operations of Algoma Ore Properties, Ltd., mining subsidiary of Algoma Steel Corp., Sault Ste. Marie, Ont., are undergoing expansion in the Michipicoten area 110 miles north of the Soo. Production comes from the Helen mine. Plans call for hoisting 8,000 tons of carbonate ore daily. The ore is sintered. Present tonnage of 1,150,000 a year was to be increased 300,000 tons, costing $1-million. Another 72-in. sintering machine is being added to Wawa plant, shown on p. 107, to make three 60-in. machines and two 72-in. machines. Conveyors underground are being speeded up to move more ore. Alexander and Victoria mines adjoining Helen are being readied for production.

Among other iron ore developments in Ontario, Bethlehem Steel's new open-pit magnetite mine at Marmoraton is outstanding. Drilling has indicated enough ore to provide 500,000 tons of 60-65% concentrate annually for 25 to 30 years. Crushing plant and 2,500-ton concentrator are to be ready in 1954.

Exploration Elsewhere. Jones & Laughlin's Jalore subsidiary, which previously had explored areas in the Michipicoten district, has been active elsewhere, drilling anomalies under option.

U. S. Steel's Oliver division likewise has been drilling an anomaly near Simcoe.

Trent River Iron Mines Co., Ltd. (Warren S. Moore, Duluth), had two potential producers—one in the Marmora area, Ontario, and the old Bristol open pit in Quebec.

Greater Output for Wabana. Efforts by the Government to develop Newfoundland's resources include Wabana iron ores, exploited by Dominion Ore & Steel Co. and credited with yielding over 40-million tons. Grade is currently 53% iron, 12% silica maximum. Worked in three mines on Bell Island, the beds dip at 8 deg. under the water for 2¼ miles to a vertical depth of 1,700 ft. Reserves are large, but the extent of mining depends on the need of keeping proper cover between the workings and the sea.

Present program involves doubling hoisting capacity to give 2.8-million tons in place of 1.3 to 1.5-million. This will supply Dominion company's requirements and permit export.

EL PAO IRON ORE shipped by rail to Palua, on Orinoco, then in barges to Puerto de Hierro, is being unloaded for transfer to ocean carrier.

Substantial Deposits on Vancouver and Texada Islands in British Columbia, have been the source of material shipments to Japan, which could be increased. They could be made the basis of a larger local steel industry in the opinion of some.

Argonaut Co., subsidiary of Utah Construction Co., plans to develop deposits for export, also to build a magnetic separation plant on Texada Island, and to spend $3-million in the Quinsam district to improve shipping facilities.

Iron From Titanium Ore. Two deposits at Allard Lake, Que., held by Quebec Iron & Titanium Corp., are estimated to contain respectively 100-million tons and 12-million tons, averaging 35% iron and 32% TiO_2. Iron is separated from titanium. Equipped for smelting 1,500 tons of ore per 24 hours, the plant yields 480 tons of refined iron daily.

Magnetite separated from ilmenite mineral at National Lead Co.'s McIntyre development, Tahawus, N. Y., is also marketed by the company.

Venezuela's El Pao Mine and Cerro Bolivar

Bethlehem Steel Co.'s El Pao mine, operated by Iron Mines Co. of Venezuela in the Caroní River region south of the Orinoco, has been in production since May, 1951. Output reached 1,969,802 tons in 1952, 700,000 more than in 1951, and is expected to be near 2½-million in 1953. It is to be raised to 3-million tons.

Ore is mined with power shovels, loaded into cars, delivered by railroad to Palua, transferred by shallow-draft barges to Puerto de Hierro, where it is transhipped into ocean-going vessels for delivery to Sparrows Point and other East Coast ports in United States.

U. S. Steel Corp.'s Orinoco Mining Co. expects to start shipping iron ore from Cerro Bolivar to the new Fairless steel works at Morrisville, Pa., in 1954. Tonnage is put at 500-million up, grade averaging about 63% iron, dry analysis. A 90-mile railroad and highway are to be built from mine to junction of Caroní and Orinoco where a new port, called Puerto Ordaz, has been built. A small group of American contractors headed by Morrison-Knudsen de Venezuela and the Link-Belt Co. and associates, reinforced by a score of

MARCONA ORE, Peru, is trucked to Port of San Juan, loaded into ocean vessels. Facilities are to handle 2-million tons per year.

Venezuelan contracting firms are handling the miscellaneous construction jobs involved in the project.

Bechtel is building all mine facilities and constructing port and ore-loading facilities, including power plants, material-handling, housing, water-supply and sewer systems. The dock was prefabricated in Orange, Tex., and floated to its present site.

A waterway 26 ft. deep has been provided, by dredging, for the ore boats that will ply between Puerto Ordaz and Fairless Works. Starting at Puerto Ordaz, this continues down the Orinoco and in the delta follows the Macareo channel to deep water. The Gahagan-McWilliams companies have divided the dredging work between them. About a third of the 154½ nautical miles from port to sea had to be dredged. The cost of the original dredging is put at a surprisingly low figure. The work is done. The Orinoco company had already dredged the Caroní and waters around Puerto Ordaz.

Between mine and port, ore movement is based on use of trains of 125 90-ton cars, each being hauled by three 1,600-hp. diesel-electric locomotives. Grades to port will be largely downhill. The limiting factor on the loaded haul will be braking, and on the return trip will be the power required to haul empty cars up grades as high as 3%.

The car dumper at Puerto Ordaz will handle 67 ore cars per hour, dumping into a crusher. The ore will be stockpiled by an ore bridge and conveyor. A gravity system will be used in reclaiming for shipment.

To handle ore shipments from Cerro Bolivar at Mobile, Ala., which are expected to begin early in 1954, U. S. Steel's TCI Division has built a new terminal there.

Brazil's resources of iron ore, especially those of Matto Grosso, Minas Gerais and Amapá, are large enough to permit exporting iron ore for many years in quantities far greater than heretofore, according to a recent joint memo of the Brazilian government and the Committee of Economic Development in Washington.

Two U.S. Companies Join To Make Ore in Peru Available Here

Marcona Deposits Opened in Peru. Iron ore shipments to the United States from Marcona Mining Co.'s property in Peru started late in April, 1953. The enterprise is a joint venture of Utah Construction Co. and Cyprus Mines Co., centered on exploiting the Marcona iron ore deposits 300 miles south of Lima. A long-term concession was granted by Corporacion Peruana del Santa, a Government corporation. Initial capital outlay exceeded $6-million.

The deposits, in the Department of Ica, cover an area of 18 x 12 miles. Some 100-million tons of ore averaging 60% plus iron and with phosphorus and sulphur contents low enough to meet requirements of the mills have been developed by diamond drilling. The ore occurs at surface and will be mined by open-pit methods. It consists chiefly of hematite and magnetite with some limonite. Overburden is thin. Save for removing sand from the drifts by screening and crushing at the mine, no beneficiation is required. Ore-handling facilities at the mine and the port of San Juan are designed for a yearly production of more than 2-million tons. Ore mined will be exported to steel plants in the United States, with initial shipments being made to U. S. Steel Corp. at Mobile, Ala., and Fairless, Pa. A. D. Christensen is president of Marcona.

Sweden, Norway, Finland

Iron mining in Sweden is showing the effects of the current widespread demand for ore. To increase output of the Kiirunavaara mine to 15-million metric tons per year from 9-million the Grängesberg Co. and the Swedish State, joint owners of Luossovaara-Kiirunavaara Co., undertook, starting June, 1951, to change over from open-pit to underground mining, which would be more profitable in view of the increasing pit depth. The project should be completed in 1957. The open pit will be exhausted three years later. Rail transport in the pit is to be replaced by truck haulage using 30-ton Euclids.

Underground, a highly mechanized sub-level caving system will be adopted. On the haulage level the ore will be hauled by electric locomotives in 25-ton cars to a central group of 8-10 hoisting shafts, each with a capacity of 500 metric tons per hour. Before hoisting, the ore will be crushed to minus 4-in. Four-rope Koepe winders with counterweights will be used and bottom-dumping 20-ton skips.

(Continued on page 168)

COPPER

New Copper Projects Operating, In Construction, Or Planned

Company	Project	Cost $	Reserves tons	Grade % Cu	Production tons ore per day	Production tons Cu per yr.	Year of Full Production
			UNITED STATES				
A. S. & R. Co.	Silver Bell, Ariz.	17,000,000		−1.0	7,500	18,000	1954
Anaconda Copper Min. Co.	Greater Butte Project, Mont.	29,300,000	130,000,000	+1.0	15,000	45,000	1954
Anaconda	Yerington, Nev.	38,000,000	35,000,000 (oxide ore)	+1.0	11,000	33,000	1954
Bagdad Copper Co.	Bagdad, Ariz.	14,000,000	30,000,000 30,000,000 (oxide)	0.754 0.435	9,000	13,500	1955
Calumet & Hecla Co.	Osceola Mine	6,500,000			3,000	7,000	1954
Kennecott Copper Corp.	Deep Ruth	14,000,000	25,000,000	−1.0	8,000	18,000	1954
	Kimbly Pit		3,500,000	−1.0	4,500	9,000	
Magma Copper Co.	San Manuel, Ariz.	120,000,000	367,624,000 (sulphide) 111,876,000 (oxide)	0.785 0.717	30,000	70,000	1956
Miami Copper Co.	Copper Cities, Ariz.	16,000,000	33,000,000	−1.0	10,000	22,500	1954
Miami Copper Co.	Miami Ext.	3,000,000	23,000,000	0.5	10,000	11,500	1955
Phelps Dodge Corp.	Lavender Pit, Ariz.	25,000,000	41,000,000 31,000,000 (leaching)	1.14 0.42	12,000	38,000	1955
White Pine Copper Co.	White Pine, Mich.	70,000,000	309,000,000	1.10	12,500	35,000	1955
			CANADA				
Campbell-Chibougamau Mines, Ltd.	Merrill Island, Que.		1,050,000	3.5	2,000	18,600	1955
Noranda Mines, Ltd.	Gaspe Copper Mines, Ltd.	30,000,000	67,000,000	1.3	6,500	25,000	1955
Sherritt-Gordon Mines, Ltd.	Lynn Lake, Man. Ni-Cu-Co	35,000,000	14,055,000	0.618	2,000	4,000	1955
Ventures, Ltd.	Opemiska Copper Mines, Ltd.		1,054,000 (est.)	4.82	400	6,000	1954
			SOUTH AMERICA				
Chile Copper Co.	Chuquicamata, Chile.	120,000,000	Not fully determined	2.0	30,000 (sulphide)	250,000	1954
A. S. & R. Co.	Toquepala, Peru	160,000,000 (est.)	400,000,000	+1.0	22,000	100,000	Indefinite
			AFRICA				
Mufulira Copper Mines, Ltd.	Chibuluma, N. Rhod.	10,100,000	7,300,000	5.23		19,000	1956
Mufulira	Baluba	28,000,000 (est.)	20,000,000 (est.)	3.56		24,000 (est.)	Indefinite
Rhokana Corp., Ltd.	Bancroft Mine, N. Rhod.	31,000,000	80,000,000	3.6	5,000	48,000	1954
Rhokana	Leach plant				6,000	40,000	1956
			AUSTRALIA				
Mt. Lyell Min. & Ry. Co., Ltd.	West Lyell		40,000,000	0.70		10,500	1956

New Growth For The Red Metal

Although copper consumption by 1963 will run well beyond 1953's level, consumers need fear no shortage. The reasons why appear opposite and in new projects shown on following pages

The Lavender Pit

IN LATE 1950, Phelps Dodge Corporation decided to develop as an open-pit mine a low-grade body of ore located in the Warren Mining District near Bisbee, Arizona. Engineering studies and drilling indicated at that time that the orebody contains 41-million tons of concentrating ore of an average grade of 1.14% copper; 31-million tons of material to be leached of an average grade of .42%; and 70-million tons of waste to be moved.

The project, now known as the Lavender Pit, involves considerable waste removal and required the acquisition of drilling equipment, electric shovels and 25-ton trucks for the initial waste stripping. The Lavender Pit will be over two-thirds of a mile long and about half a mile in width at its greatest dimensions. From the highest point to the bottom of the finished excavation, the depth will be approximately 900 ft. Waste stripping started in 1951, and good progress has been made to date in connection with waste removal. Copper production is scheduled to commence by the end of 1954. On the basis of present estimates, the property is expected to produce about 76-million lbs. of copper annually for some 11 or 12 years.

A new concentrator and other related facilities are now under construction. The concentrator will have a projected capacity of 12,000 tons of ore per day and is located near the edge of the pit. The concentrating ore will be moved from the pit in 25-ton trucks to the primary crusher. The crushed ore will travel by belt conveyors to the concentrator.

Negotiations with the appropriate Government authorities, looking toward certification of the Lavender Pit project as an emergency facility, and a contract for sale of a portion of the production of the project to the Government, were undertaken in 1950 and concluded in 1951. Under the contract between the Government and Phelps Dodge Corporation (entered into pursuant to the Defense Production Act of 1950, as amended), Phelps Dodge bears the entire cost of developing and equipping the Lavender Pit as an open-pit mine and of installing the plant necessary to treat the ore. That cost is estimated at about $25-million. Under the contract the corporation has the right to call on the Government to purchase up to 225-million lbs. of copper out of the first 300-million lbs. produced from the Lavender Pit at a price of 22¢ per lb. with an escalator clause. The Government has the right to purchase any part of the 300-million lbs. at the floor price or the market price, whichever is higher.

To see the Pit, please turn the page ➡

THE LAVENDER PIT will occupy roughly the area outlined in red. (Dotted line shows where pit limit drops behind a hill.) Letters indicate: A, site of concentrator; B, mine office; C, primary crusher station; D, town of Bisbee;

Photo by Tom Ellinwood, Arizona Daily Star, Tucson, Ariz.

E, road to waste dump; F, new highway grade. Pit limit crosses old Sacramento Pit at upper left corner of new pit area. Current activity is on hill just left of center fold. Waste haulage will eventually be by railroad.

The Silver Bell Project

EVERYONE INTERESTED in open pit mining who has been through Arizona this past year seems to have stopped off to see the Silver Bell project of American Smelting & Refining Co., about 40 miles northwest of Tucson.

Part of this desire to visit Silver Bell arose from natural interest in any new pit operation, but part is certainly due to curiosity aroused by the interesting mining methods being tried there.

For example, Isbell Construction Co., Reno, Nev., which has the contract for the stripping and the first six months of mining at Silver Bell, tried out a rotary drill rig for blast hole drilling.

Since February, 1952, when stripping got up to full speed, Isbell, under the direction of John Ward, Jr., has moved about 11 million tons of waste and has about another 2 million to go.

Two pits are being developed; the Oxide (in name only) and the El Tiro. The Oxide pit is nearer production. The ore is monzonite and alaskite with some limestone and quartzite. Copper content is under 1%.

Mining in 40-ft. benches, two 6-yd. 120-B shovels loading Euclid 25-yd. trucks turn out about 5,000 tons per shovel-shift in the Oxide pit. The trucks use two 190-hp. G.M. engines with Allison 3-stage torque converters.

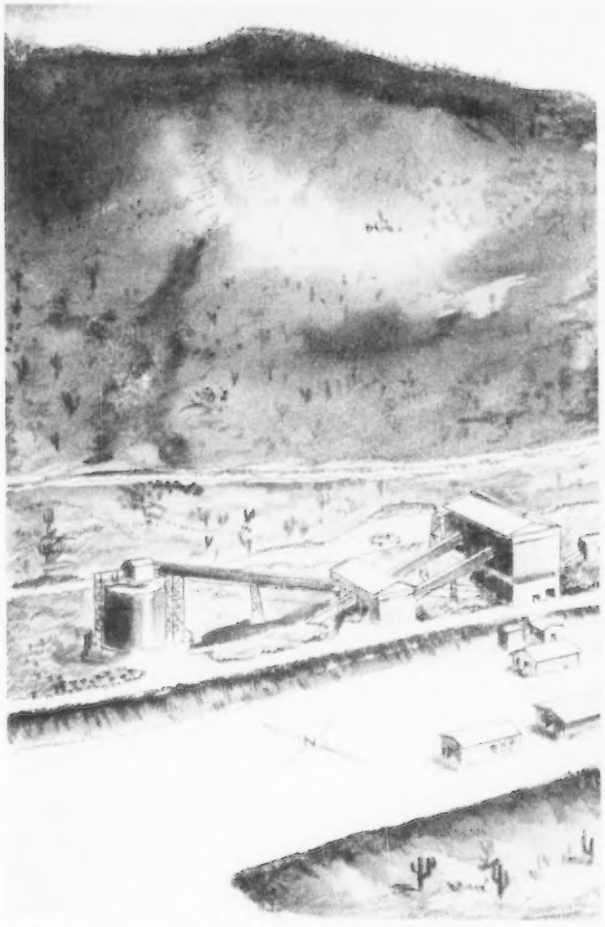
Drilling is done with 29-T churn drills (9-in. holes) and the one Joy 58-BH rotary rig, which uses a 7⅞-in. bit. Lately the drill has been switched to a 9-in. bit (Hughes Tool, alloy steel). With the smaller bit, the drill puts down 22.6 ft. per hr.; with the 9-in. bit, the drill turns out 14.5 ft. per hr. The 9-in. churn drill averages about 7.5 ft. per hr. in the same ground.

Bit cost for the 7⅞-in. Joy drill has run about 9¢ per ft. Bit life averages 1,500 ft.

The mill, with a capacity of 7,500 tons of ore daily, should be completed during the first quarter of 1954. Stearns-Roger Mfg. Co. of Denver is building the mill; much of the design was done in the Salt Lake offices of A. S. & R. under the direction of Norman Weiss, and by F. C. Torkelson of Salt Lake City. Fred Nixon is in charge at Silver Bell for Stearns-Roger.

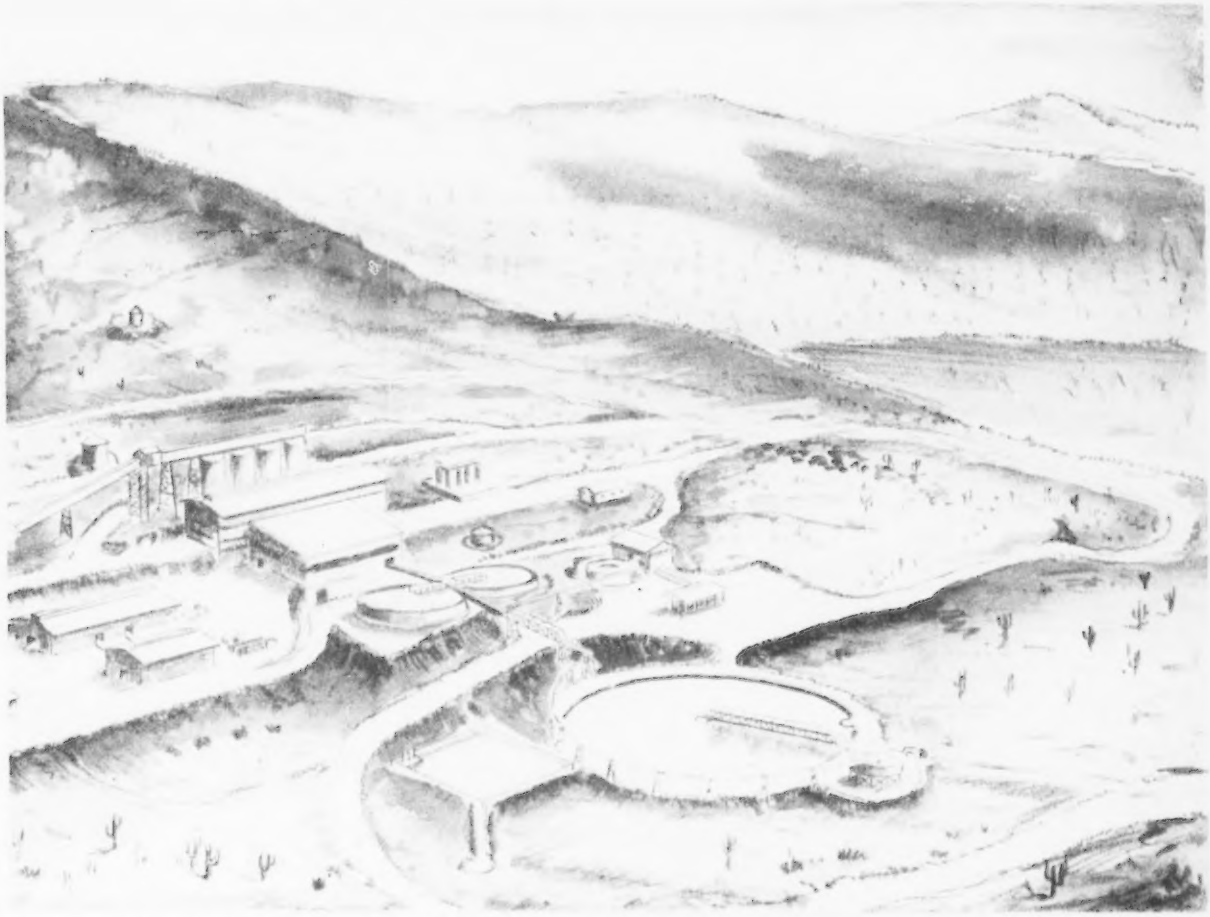
Life of the property, with the present reserve position, is estimated at about 12 years. Original capital investment is about $17-million. Production will amount to about 18,000 tons per year of copper contained in concentrates shipped to the El Paso smelter. Of the first 197 million lb. of copper produced, the DMPA will take 177 million lb. at a floor price of 24½¢, subject to adjustment of operating costs.

D. R. Purvis is superintendent at Silver Bell for A. S. & R. The property is under the general supervision of T. A. Snedden, manager of the southwestern division of A. S. & R.'s mining department.



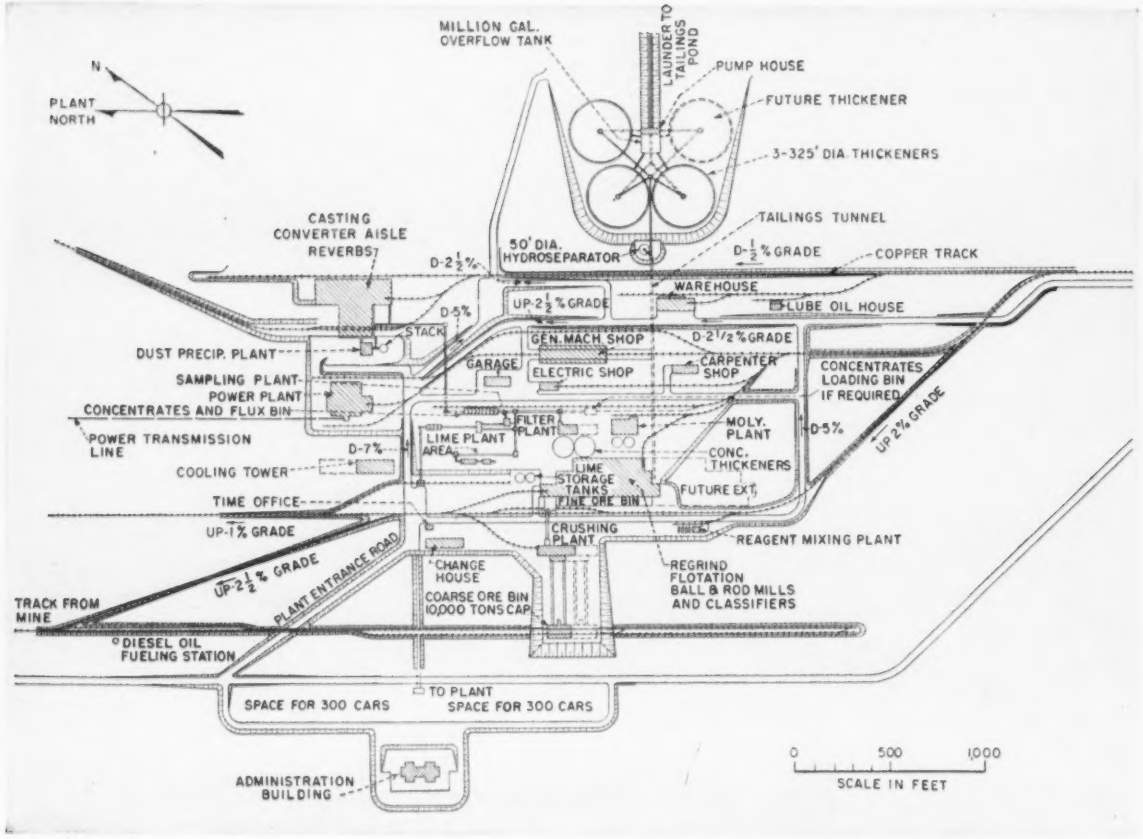
SILVER BELL'S CONCENTRATOR will handle 7,500

ROTARY RIG speeds up drilling. Using 600-lb. pressure on bit at 60 rpm, drill does 172 ft. of 7⅞-in hole per shift.



tons daily. Ore comes by truck from mine off to left; all crushing takes place in building at dumping point left of center.

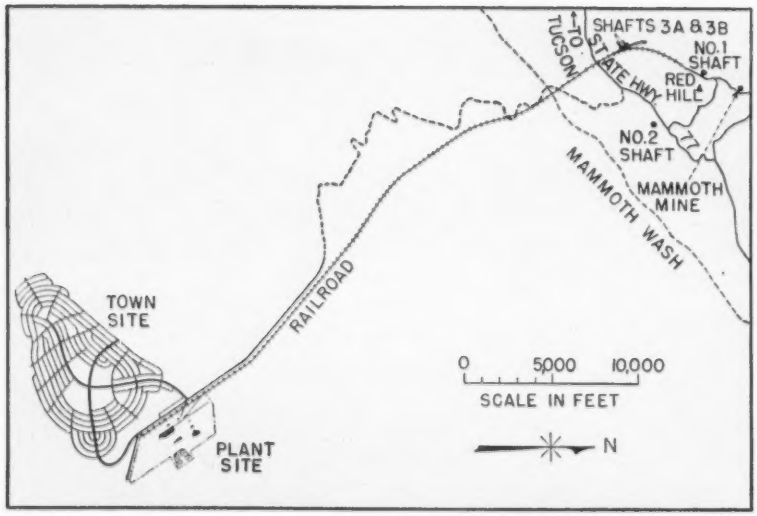
OXIDE PIT really contains sulphide ore. Reserves here and in El Tiro pit will supply about 12 years' output. Mine was opened in 1895 for lead-silver, later produced copper for Imperial Copper Co., in 1915 was taken by A. S. & R.



PLANT SITE is on gentle slope. Mill will treat 30,000 tons daily; output will be 70,000 tons of copper yearly.

San Manuel

Largest of the new underground mining projects completes negotiations, now enters construction

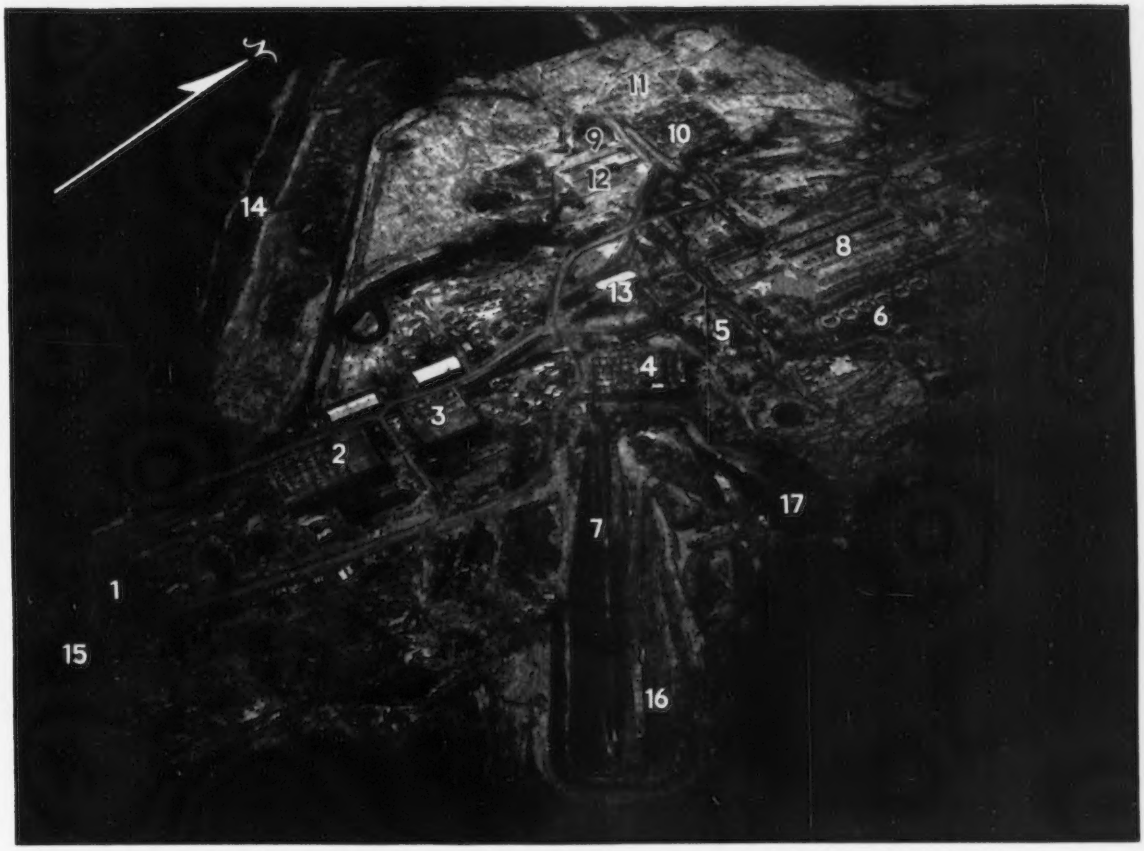


TOWN SITE, state's tenth largest, is 7 mi. from Red Hill, mine's landmark.

WITH AWARDING of contracts covering mill design and plant and town construction, San Manuel is now on the road to production.

The company has 367-million tons of sulphide ore of 0.785% Cu grade. Three shafts have been collared, and development from the existing two shafts is continuing, in order to prepare the first lift for mining by block caving. About 16,600 ft. of development has been done on two levels; the main haulage level is about one-fifth complete.

Construction and mine development, under the supervision of Wesley Goss, vice-president and manager, will take about 3½ years. Total capital investment will be about $120-million. The townsite will provide homes for an eventual 7,000 persons. San Manuel, itself, will employ about 1,800 men and women.



PLANT SITE on June 2, 1953. See text to identify units that will be producing 35,000 tons copper yearly by 1955.

With about 30% of construction done, the Copper Country's newest mine is making good progress

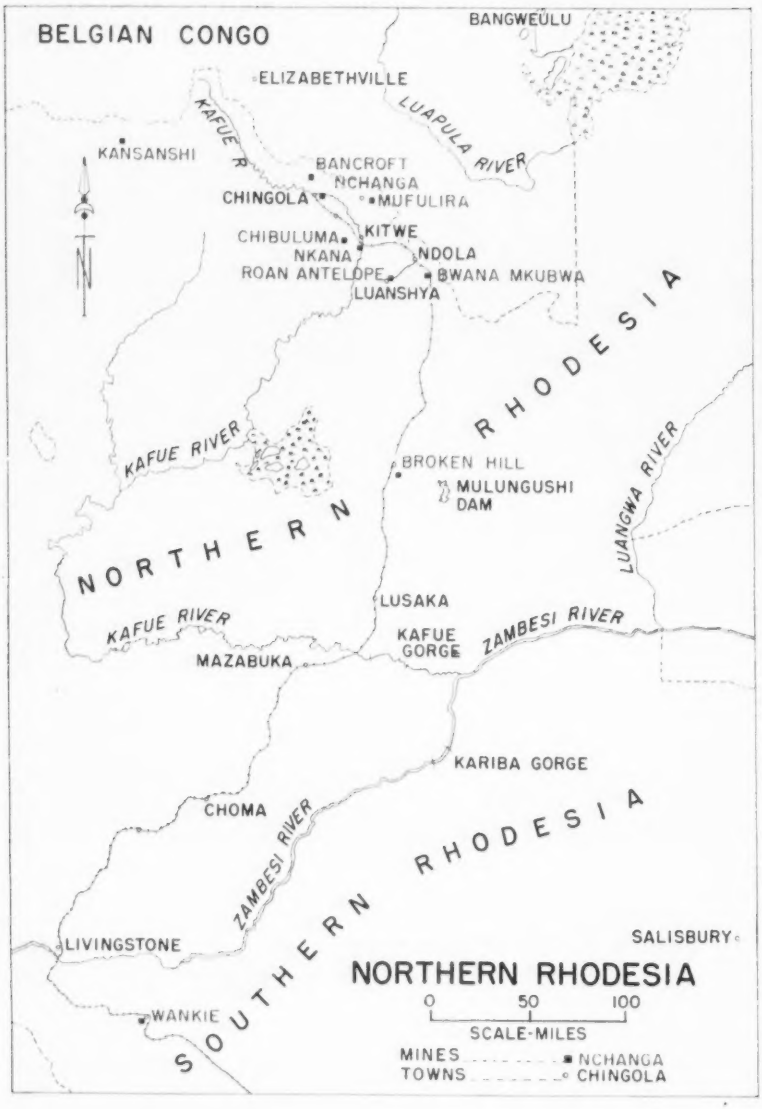
White Pine

IN MICHIGAN'S UPPER PENINSULA near Ontonagon, White Pine Copper Co. is building the plant to mine a 309-million-ton orebody carrying 1.10% Cu.

Units numbered on the photograph are as follows:

1. Administration building.
2. Warehouse and shop.
3. Vehicle repair.
4. Mine change house.
5. Crushing plant.
6. Fine ore bins.
7. Inclined tunnel to mine.
8. Mill foundation.
9. Stack foundation (500 ft.).
10. Power house foundation.
11. Smelter site.
12. Smelter feed, foundation.
13. Flux crusher foundation.
14. Diversion ditch.
15. Entrance to works area.
16. Mine conveyor tunnel.
17. Mine ore storage pile.

SHUTTLE CARS, like this Joy 18-ton diesel, will move 12,500-ton daily output.



The Copperbelt

High grade orebodies and rapidly-expanding plant capacity give Rhodesian mines a new prominence

H. L. Talbot*
F. H. Chapman*
Kitwe, Northern Rhodesia

*Messrs. Talbot and Chapman are consulting metallurgist and assistant consulting metallurgist, respectively, for Anglo American Corporation of South Africa, Ltd. Their detailed analysis of expansion programs for Rhodesian copper and cobalt will appear in an early issue.

GIGANTIC, but still exhibiting the buoyancy of youth, the metal mining industry of Northern Rhodesia in 1953 bears little resemblance to its humble modern beginnings a scant quarter-century ago.

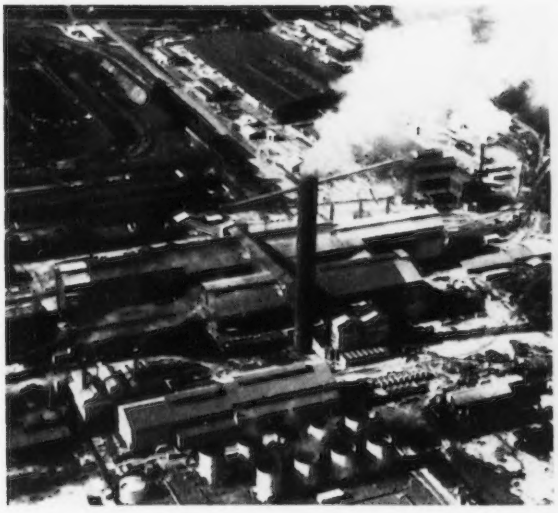
Full maturity still lies ahead. Ambitious new projects are commissioned year after year, while exploring and planning of new ventures continue unceasingly.

Dominating the mining and entire territorial economy is copper, produced by four large mining companies: Rhokana Corporation, Ltd.; N'Changa Consolidated Copper Mines, Ltd.; Roan Antelope Copper Mines, Ltd.; and Mufulira Copper Mines, Ltd. Together in 1952 their operations produced 350,000 short tons of copper as electrolytic shapes and blister, accounted for over 90% of the total value of mineral production, and the same proportion of the territory's total exports.

Presently rated as the world's third largest copper producing country, Northern Rhodesia is still great in potential. Two new mines are preparing for production; five new prospecting companies are active; and other important properties previously known, including Baluba and Kansanshi, are receiving thorough examination.

Scheduled for production in late 1955, the Chibuluma mine (one of the two new producers just referred to) will ultimately provide a modest but significant production of 19,000 short tons of copper yearly, from reserves presently proved at 7.3-million tons averaging 5.23% copper. Underground development is proceeding rapidly, mine buildings are under construction, and a concentrator will be erected at the mine. The new enterprise will employ about 220 Europeans and 1,500 Africans when production begins.

Intense activity surrounds the other new property, that of the Kirila Bomwe and Konkola orebodies situated near the Congo border in undeveloped country northwest of existing N'Changa operations. To be known as the Bancroft mine, in recognition of the famous Canadian geologist, Dr. J. A. Bancroft, whose knowledge and foresight have made so outstanding a contribution to the development of the Copperbelt, this new Rhokana property has available about 80-million tons of ore with an average copper content of 3.6%. Shaft sinking is proceeding on both sections, and a modern town is going up at Kirila Bomwe, the focal point of future operations. Production, which will probably begin within five years, is planned for an annual rate of 48,000 short tons of copper.



RHOKANA'S COPPER SMELTER includes a new electrolytic plant (background) and new cobalt plant (right).

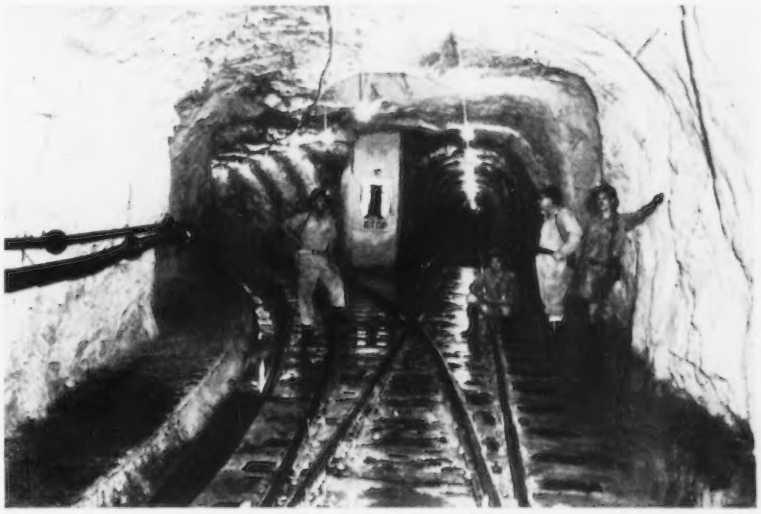
N'CHANGA'S SURFACE PLANTS include leaching and electrolysis (foreground), "B" shaft and mill (rear).

Ore reserve figures give an index of the impressive potential of the Copperbelt's mines. More than 600-million tons of ore has been proven, with an average grade of 3.7% copper, more than 20-million short tons of the red metal.

Production in 1952, however, was not a satisfactory reflection of this reserve potential. Recurrent shortages of coal were offset somewhat by burning wood, but the programmed goal of 400,000 short tons of copper, for which facilities exist, was not realized.

The Copperbelt boasts four large flotation concentrators, with an annual milling capacity of about 15-million tons of ore. There are three conventional reverberatory smelting plants, by far the largest of which is that of Rhokana Corp. at N'kana. Following recent extensions and modernization, which still continues, its productive capacity of approximately 16,000 short tons of copper per month is the highest in the British Commonwealth. Its capacity will eventually be increased by another 25% to handle smelting concentrates from the milling plants of Rhokana, N'Changa, and Bancroft.

There are two electrolytic copper refineries in the territory. In 1951, the refinery of Rhodesia Copper Refineries Ltd., at N'Kana, jointly owned by Rhokana and N'Changa, was extended to a nominal annual capacity of 140,000 short tons per year. Mufulira has now embarked on electrolytic refining of a large proportion of its production. The first anode and tankhouse unit at Mufulira was commissioned late in 1952; by 1955 a second unit will be in operation. Total annual capacity will be about 80,000 short tons.



PERMANENCY characterizes main cross-cut haulage in new South Orebody shaft of Rhokana Corporation, one of four producers in Rhodesia's Copperbelt.

Among the more spectacular developments of the Copperbelt are the operations of N'Changa, the youngest and the largest producer. Hand in hand with expansion of N'Changa's mining and concentrating facilities to the existing milling rate of 180,000 tons of ore per month, comes construction of a leach plant to treat oxide concentrates. This plant with a nominal capacity of 2,200 short tons of cathode copper per month, was commissioned late in 1951, but power limitations prevented regular operation until March, 1952.

By the end of the year further expansion will increase N'Changa's productive capacity to about 120,000 short tons of copper per year, of which 40,000 tons will be the leach plant potential. N'Changa seems destined to become the largest single copper producer in the British Commonwealth.

ALUMINUM——— *"No limits can yet . . . .*

World Aluminum Supply Will Reach New Heights . . . .

World Production of Primary Aluminum

(in thousands of short tons)

Country	Start WW II 1939	War Peak 1943	Post War 1946	Post War 1949	Korea 1950	Korea 1952	Planned Capacity 1953	Planned Capacity 1954	Planned Capacity 1955
U. S.	164	920	410	604	719	937	1393	1515	1544
Canada	83	496	193	369	397	496	496	548	603
Free Europe (Total)	414	494	140	246	272	453	490	521	541
Austria	5	9	1	16	20	34	44	44	44
France	58	51	53	60	67	116	100	100	100
Germany	215	267	1	40	31	111	114	114	114
Italy	38	52	12	28	41	59	65	65	65
Norway	34	26	19	40	51	58	60	75	95
Spain	1	1	1	1	2	5	5	5	5
Sweden	2	4	4	4	4	7	11	11	11
Switzerland	31	21	14	23	21	29	33	34	34
United Kingdom	27	62	35	33	33	31	40	40	40
Yugoslavia	3	1	—	1	2	3	18	33	33
Asia (Total)	32	157	17	33	59	53	76	90	90
India	0	1	4	4	4	4	4	4	4
Japan	24	126	3.5	19	27	46	68	82	82
Korea	0	14	5.5	—	26	—	—	—	—
Formosa	8	16	—	1	2	3	4	4	4
Manchuria	—	—	4	9	—	—	—	—	—
Australia	0	0	0	0	0	0	0	6	14
Brazil	0	0	0	0	0	2	8	13	13
Iron Curtain (Total)	82	76	85	156	187	350	?	?	?
U. S. S. R.	81	68	83	152	187	330	?	?	?
Hungary	1	8	2	4	—	20	?	?	?
Totals									
Free World	693	2067	760	1252	1447	1941	2463	2693	2805
Iron Curtain	82	76	85	156	187	350	?	?	?
Grand Total	775	2143	845	1408	1634	2291			

. . . . But Producers Are Betting Demand Will Stay a Jump Ahead

I. W. Wilson,
President
Aluminum Company of America

"The rapid growth of the aluminum industry to all-time record size during the past year has brought aluminum to a position of leadership in the non-ferrous metals field. And the industry's expansion is continuing at full speed.

"A careful study of existing market trends indicates that aluminum will rise to new heights of usefulness in many fields. Among the uses which hold great future promise as large tonnage consumers are: electrical conductors; building and architecture; automotive and air transportation; and chemical processing equipment. And there are many additional fields which will require large quantities of this light metal for new developments."

R. S. Reynolds, Jr.,
President
Reynolds Metals Co.

"The most notable feature of this rapidly mounting aluminum production is the widespread diversification among the consuming industries. When this country last attained a similar level of aluminum production, during the war year 1943, about 80% of it went into military aircraft. Now the military share of the total runs to 25 or 30% and of that probably no more than half goes into military aircraft. The other 70% is being fanned out to almost the whole range of civilian industry, including such big consumers as the construction, automotive, electrical, appliance and packaging industries. This general acceptance by industry of aluminum as a major basic metal, second only to steel now, provides greater stability for aluminum markets and stimulates their further growth.

"The outlook for aluminum continues to be bright, in our opinion, and we look forward during the months and years ahead to new opportunities for enlarging our markets and sales, especially as aluminum supplies not actually needed for defense are made available for civilian use."

Nathanael V. Davis,
President
Aluminium Limited

"The two main economic considerations which have led Aluminium Ltd. to cultivate the American market are: first, an anticipated long-range growth in United States requirements which we believe internal American production sources will be hard put to satisfy with low-cost aluminium; and, second, a conviction that the fundamental economics of low-cost production will tend to emphasize the desirability of putting greater reliance on Canadian sources for primary aluminium.

"This belief is founded on the fact, now widely recognized, that the production of aluminium calls for extraordinarily large amounts of electric power at a price too low to be attractive to suppliers in populated or industrial areas. As an example of the latter, an aluminum smelter located in a region which is growing industrially will consume a vast amount of power which many manufacturing concerns, capable of employing often 50 or more times as many people per unit of power, would be able and eager to use at higher prices.

"Despite rapid industrialization in Canada, low-cost power sites, including many yet undeveloped, are available in areas where there is little or no industrial competition for power."

U. S. Companies Spend $735-Million for More Capacity

WHEN AN INDUSTRY puts $735-million into expanding its production capacity, it reflects a barrelful of confidence in the future. That's what the U. S. aluminum industry has done since the start of the Korean conflict, or will do in the next few years. The 723,000 tons of primary metal added annually to the nation's capacity will bring it to an unprecedented total of over 1½-million tons a year. In addition, another 250,000 tons per year will come into the U. S. market from Aluminium Ltd. of Canada.

This is a lot of aluminum, but U. S. producers aren't worried about glutting the market. Skeptics point out that they have a hedge whereby they can put excess metal into the Government stockpile, but actually, the aluminum people don't think that this will be necessary. First, they point out that their market is in the growth industries—construction, transportation, utilities and household appliances. What's more, they are sure that the use of aluminum can be expanded within these fields, presumably at the expense of other materials. On top of this they have one or two aces up their sleeves—new fields which have yet to feel the impact of the light metal.

In fact, thinking in the industry now reflects impatience with the situation that sees 30% of their output earmarked for the military. If this metal supply were available, they say, they could expand into new markets now without waiting for new capacity to come in.

This preoccupation with market research is a characteristic of aluminum that distinguishes it from other base metals and is paralleled only by the International Nickel Co. Rather than the attitude of "here-is-the-metal-come-and-get-it," aluminum companies examine metal usages everywhere with the question "Can aluminum do this job better and cheaper and if not, why not?" If the market can be established, production can be increased. That is the history of aluminum. And it holds true for the industry's present ambitious expansion.

Price has been another aluminum asset. It's stability has permitted the consumer to concentrate on cost of operation, rather than on the profit or loss bound up in big inventories. Consumers have been quick to recognize this advantage where different metals are in close competition, a fact pointed out at the last meeting of the American Zinc Institute. Talking individually to officers of different aluminum companies, it becomes apparent that they regard price, not in terms of this year's profit, but in terms of markets five years from now.

Expansion of U. S. Aluminum Producing Capacity Since Korea

Company	Capacity (thousands of tons)	Total Cost (millions of dollars)
PROJECTS STARTED		
Aluminum Company of America	205	$250
Reynolds Metals Co.	184	185
Kaiser Aluminum & Chemical Corp.	230	190
Anaconda Aluminum Co.	50	45
Harvey Machine Co.	54	65
Total	723	$735
TENTATIVELY PLANNED		
Olin Industries	110	$123
Wheland Co.	50	70
Total	160	$193
Grand Total	883	$928

This approach may simply be characteristic of a young industry. Aluminum management is still close to production as compared with other base metals where management is linked with complex financial groups. A small point but indicative—none of the three present aluminum producers have their head offices in New York, the nation's financial center. Aluminum men still measure the company's accomplishment in tons of aluminum rather than dollars.

Aluminum has gotten breaks, too, that aided in its meteoric rise. Its inherent characteristics, high strength-to-weight ratio, corrosion resistance, good thermal and electrical conductivity, and workability, give it competitive advantages. Even so, general acceptance of aluminum might have been a serious obstacle were it not for World War II. When airplane production reached 100,000 planes a year, Government specifications called for about 80% aluminum. This meant that hundreds of contractors and sub-contractors and more than a million of their workers became familiar with, and had equipment for handling aluminum. At the end of hostilities, aluminum abundance, and shortage of most other metals fostered many permanent aluminum fabricating plants. Magnesium, for example, never had the benefit of forced acceptance and now faces a handicap in overcoming customary resistance to change.

One headache for the aluminum industry, with only three producers, has been the steady suspicion of the anti-trust people in Washington. For example, the recent deal made by Alcoa and Kaiser with Alcan, whereby the Canadian producer will supply them with some 786,000 tons over a 6-yr. period, has been widely misinterpreted as a move to discourage new producers. It is rather a reflection of the established producers' bullish attitude toward the aluminum market. After all, the three current producers will be spending as much for expansion in the next few years as the newcomers will for new plants, and this new capacity will meet the same limitation of choice locations for cheap power.

New Producers

Of the newcomers to the aluminum field, Anaconda and Harvey have already begun construction at Columbia Falls, Mont., and The Dalles, Ore., respectively. Olin and Wheland have come to a dead stop because of financing. Olin has not been able to raise the necessary money through private financing and is apparently unwilling to mortgage its non-aluminum properties to raise the money, a step that Reynolds was willing to take in 1940 when they got started in primary aluminum production. Wheland has certificates of necessity for its proposed plant at Chattanooga but is seeking a firm market agreement with the U. S. Government.

In these days of talk about nationalization of industry, it is interesting to note that all funds required by companies proceeding with new plants or expansion are being obtained from private sources. Loans constituting less than 10% of this total are Government guaranteed.

Alumina: A Big Chemical Industry Between Mine and Smelter

FEW PEOPLE outside the aluminum industry realize that between the bauxite mine and the aluminum smelter there stands a large chemical industry for producing alumina. How large can best be realized by glimpses at the railroad traffic at Reynolds' Hurricane Creek alumina plant for example, where 115 carloads of ore, supplies and product are handled every day.

The alumina plant extracts alumina from the bauxite in a form pure enough to feed to the smelter for reduction. One pound of metal requires two pounds of alumina for which the alumina plant must be fed 4 lb. of bauxite. Cost of extracting pure alumina from bauxite amounts to 30% to 40% of the cost of the metal.

Commercially, alumina is almost universally prepared by means of the Bayer process. Ground bauxite, is stirred with lime and soda ash under pressure at about 300 deg. F. in a digester. Aluminum hydrate goes into solution as sodium aluminate, and the "red mud" insolubles are separted from the liquor. The liquor goes to precipitators where aluminum hydrate seed particles are added. It takes two days in this batch process for about half of the sodium aluminate to precipitate on the seed particles. The entire contents of the precipitation tanks is then pumped to a battery of thickeners. In the first set of thickeners, the coarsest particles settle out and these constitute the plant's alumina production. Particles settling out in subsequent thickeners are used for seeding and remain in the circuit until they grow large enough to settle out in the first thickener. The overflow liquor goes through evaporators and, concentrated, it is returned to the digesters.

The aluminum hydrate is put through kilns at 2,200 deg. F. to drive off the water of crystallization. The resultant white, powdered alumina is then shipped to the smelters.

The Bayer process recovers about 75% of the alumina in the ore. When low grade ores are being handled, the "red mud" from the Bayer process, which runs about 50% aluminum mainly in the form of silicates, may go through a Sinter process, which can raise overall recovery to 90%.

Alternative to the Sinter process, is the practice of sweetening low grade ores with high grade. Reynolds, for example, will increase their low grade Arkansas bauxite reserves by sweetening the ore with South American bauxite.

Recently Lobeth Corp. of Chicago announced an electrolytic process which they claim will produce 99.9% pure alumina from low grade clay at costs lower than Bayer process costs using bauxite. The continuous process is reported to have operated with a low grade kaolin (10% alumina, 80% silica) to prove that there is practically no limitation on the impurities it can handle. Electrical requirements are less than 2 kw hr. per pound, but at a smelter where power consumption is a critical factor, even this amount of power could be prohibitive.

Beneficiating clays and other sources of aluminum besides bauxite is dealt with in the Paley report. The Kalunite process using alumite; the ammonium sulphate process and the lime-sinter process using clay; and the lime-soda-sinter process using anorthosite are mentioned. Costs of producing alumina by these methods are less than 50% higher than by Bayer process treating high grade bauxite.

A high iron bauxite process, called the Pederson process has been used commercially in Europe and can be applied to lateritic ores.

Technical Briefs

Foamed Aluminum. According to literature released for a short period early this year, the U. S. Government is interested in foamed aluminum. The foamed metal maintains good structural properties, is much lighter in weight and can be sawed like a two by four. Foaming is probably done with hydrogen.

Wanted: A permanent anode for aluminum smelting. In present practice whether a pre-baked or continuous electrode (formed by feeding petroleum coke and pitch through a large consumable sleeve extending downward into the pot) is used, about ¾ lb. of carbon is consumed for each pound of aluminum produced, because the carbon combines with the oxygen released from the reduction of alumina. A permanent electrode, besides having good conductivity, would require a high melting point, great resistance to the highly corrosive cryolite bath and no affinity for oxygen.

Molten Transportation: With the special type of truck proposed for the door-to-door delivery of molten aluminum in the Reynolds-G.M. arrangement in Arkansas (p. 126), freezing is no problem. Metallurgists estimate that a well-insulated, covered crucible could keep metal in molten state for from 8 to 10 hrs., if the crucible were not cold to begin with. Metal leaves the holding furnace at 1,700 deg. F. and solidifies at 1,310 deg F. With a leeway of 8 to 10 hr., it would seem possible for any fabrication plant within 200 mi. of the smelter to take advantage of molten metal delivery and accompanying cost savings. The big question concerns the local highway department. Will they permit the transportation of molten metal over state highways if the carrier takes suitable precautions?

Subhalide Process: Alcoa is working on a process that may result in lower power consumption and the utilization of low-grade ores. At present aluminum is produced from electrothermic alloys and scrap by treating them with aluminum chloride to form a subhalide of aluminum at high temperatures. This is dissociated at low temperatures to form metallic aluminum and the aluminum chloride is recovered.

Revolutionary Pots: All of the 162 pots in the new Cia. Brasileira de Aluminio plant in Brazil, will have removable bottoms served by special railed carriages running on a lower level. Hydraulic equipment will permit replacement of bottoms with freshly prepared units in two or three hours.

4 lb. Bauxite = 2 lb. Alumina + ¾ lb. Carbon + 10 kw. hr. Electricity = 1 lb. Aluminum

BAUXITE: Reserves Are Abundant

	Nationality of Capital Control	Reserves (Millions of Tons)	Average Content % Alumina (Al_2O_3)
Western Hemisphere			
Surinam	U. S. 85%, Netherlands 15%	45–55	55–57
British Guiana	U. S. 20%, Canada 80%	55–65	59–61
United States	U. S.	32	56–59
Jamaica	U. S. 40%, Canada 60%	300	46–50
Brazil	Brazil	21–138	50–60
Haiti	U. S.	22	45–50
Dominican Republic	U. S.	12	45–50
Africa			
Gold Coast	U. K. and Canada	220	50–60
French Guiana	Canada 20%, France 80%		
Los Islands		22	50–55
Interior Deposits		88	
Nyasaland	U. K.	65	45–55
Mozambique	U. K.	11	48–52
Europe			
France	France 40%, Switzerland 20% U. K. 20%, Canada 20%	65	56–70
Russia	Russia	33	35–54
Hungary	Russia 50%, Hungary 50%	275–330	57–60
Greece	Canada 35%, Greece 65%	20–55	56–59
Yugoslavia	Yugoslavia	35–55	50–65
Rumania	Rumania	22	53–58
Far East			
Netherlands Indies	Netherlands and Indonesia	20–30	54
India	India 85%, Canada 15%	33	54–58
China	China	165	45–55
Australia	Australia	28	35–50
Malaya and elsewhere		11	
Total World		1,600–1,857	

CRYOLITE: So Little but So Vital

CRYOLITE HAS a unique role in aluminum reduction. Natural crylite, a double fluoride of sodium and aluminum, was the substance that the original inventors discovered would dissolve alumina, and permit an electric current passing through the fused solution to separate and precipitate the metal. But reserves are dwindling in Greenland, the only source of natural cryolite, and the aluminum industry must look elsewhere.

Synthetic cryolite, prepared by treating aluminum trihydrate and caustic soda with hydrofluoric acid, is now accepted as a good substitute. It contains more silica than the natural material, and natural cryolite's greater stability makes starting a potline easier, but differences are small.

With an impending shortage of fluorspar, aluminum producers are examining the decomposition of cryolite during smelting for a way to reduce consumption. For one thing, escaping fluorine can be captured and used for cryolite manufacture. A method has been worked out for producing it from aluminum silicate. Other sources include Virginia-Carolina Chemical Co. which will produce 5,000 tons of cryolite a year from by-products of other chemical plants.

Part of the 0.06 lb. of cryolite used for each pound of aluminum produced is absorbed by the potlining. At three reduction plants cryolite is now being reclaimed from old potlinings at the rate of 10,000 tons per year. Other reclamation units are scheduled.

POWER: The Key

ALUMINUM IS PACKAGED power. Consumed at the rate of about 10 kw. hr. per pound of aluminum produced, power contributes 15% to 20% of the total cost of the metal. For the smelter, this is a challenge to use power more efficiently (theoretically it requires only 3.5 kw. hr. to reduce aluminum), and to find a cheap source of power.

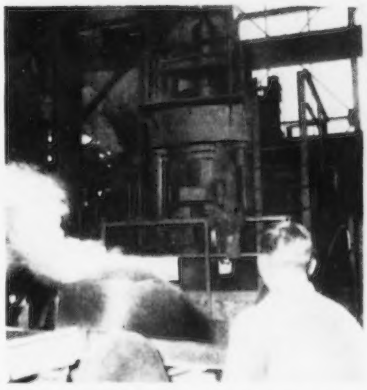
While aluminum companies are reluctant to talk about their efforts at cutting power consumption, trends hinted at include the use of high amperage (100,000 amp. and up) through the potlines, improved insulation, larger pots, and ways to maintain optimum spacing between electrodes. The Paley report has this to say: "Developments . . . are expected to lead to totally enclosed, single electrode refining cells and reduce the power requirement per pound of metal . . . to 6.4 to 6.8 kw. hr."

Hydro of course, is cheap power, but for aluminum, other conditions must be met: (1) large blocks of continuous water power capable of being developed at reasonable capital cost and available the year round; (2) little or no competing demand for power; (3) favorable transportation for incoming raw materials, outgoing metal.

(Continued on p. 307)

Carbon: $2Al_2O_3 + 3C \rightarrow 4Al + 3CO_2$

IN ALUMINUM SMELTING, carbon serves as anode, and in the pot lining, as cathode, for the electrical current that melts the alumina-cryolite mixture and breaks down alumina chemically. Oxygen thus released reacts with carbon in the anode to form CO_2, consuming $^3/_4$ lb. of carbon per pound of aluminum produced. Whether the plant uses the Soderberg pot with one huge anode, or the Niagara pot with many smaller anodes, the carbon plant at the smelter is a busy place. Here, we take you on a tour of the carbon plant at the Jones Mills smelter of Reynolds Metals which produces 2,700 to 3,000 anodes a day for five potlines of 136 pots each.

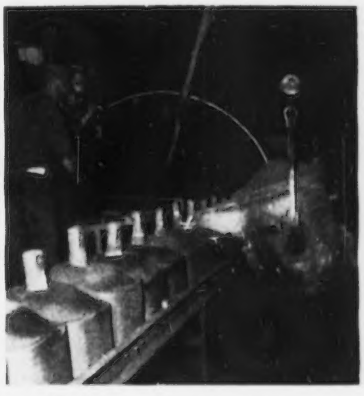


1. Hydraulic press shapes 70% petroleum coke, 30% anthracite into anode which conveyor removes.

2. Layers of green anodes covered by coke are baked for 120 hours at temperatures reaching 1,050 deg. C.

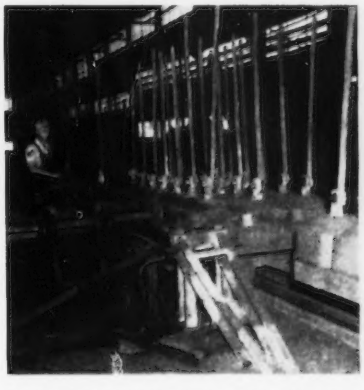
3. Baked anodes are cleaned and weighed. Average weight is 180 lb.; average life 7 to 10 days.

4. Moving on conveyor, anodes reach man who inserts reclaimed stubs in hole at top for that purpose.



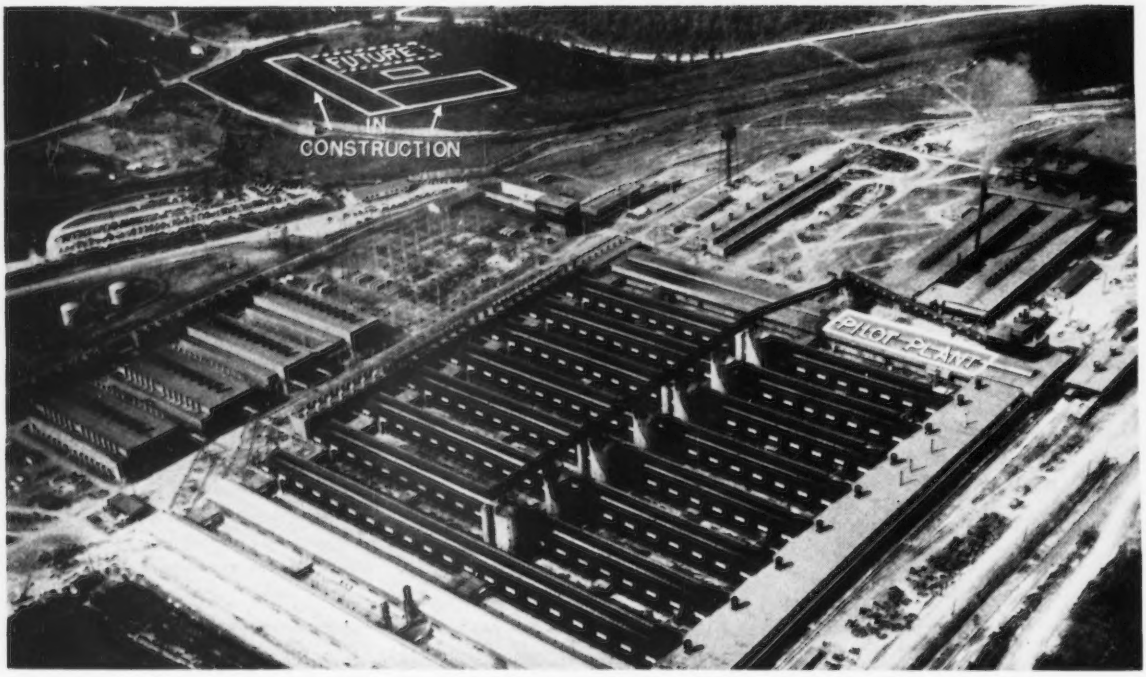
5. Molten iron is poured in around stub to secure it. A small furnace nearby melts scrap for this.

6. Copper pins for connection to bus bar at pot are bolted on. Only two men with air wrench are needed.



7. Finished anodes are loaded onto a train of tow cars for distribution to the various pot rooms.

8. Anode replaces one which has been consumed by combining with oxygen which escapes from pot.



IN ARKANSAS . . .
A New Trend for the Industry

WHEN THE FABRICAST DIVISION of General Motors Corp. starts die-casting in August at its new Arkansas plant, the operation will mark a significant milestone in the growth of the aluminum industry in the U. S. Located on the doorstep of the Jones Mills reduction plant of Reynolds Metals Co. (see photo), Fabricast's move to its supplier could well launch a trend toward the rise of important industrial centers around aluminum reduction plants, just as huge manufacturing centers sprang up around eastern and midwestern steel mills more than half a century ago.

Fabricast's plant will use up to 20,000 tons of metal a year, or about one-fifth of the Jones Mills output, to produce castings for hydraulic transmissions for autos and tanks, and other precision parts.

Special trucks, mounting well-insulated, covered crucibles will carry the metal less than half a mile right from the Reynolds' pot rooms to the Fabricast holding furnace. A hydraulic dumping device on the trucks will make pouring simple. Two of the 10 Jones Mills pot rooms will be assigned supply of the silicon alloy. Fabricast will add its own magnesium. The plant will employ 800 persons and will be readily expandable if necessary.

Savings from this arrangement are mainly the result of eliminating remelting on the part of the consumer. One metallurgist estimates unofficially that the fabricator, by using molten metal, can save ½¢ per pound of aluminum used. In Fabricast's case, this means a saving of a cool $200,000 a year.

The reduction plant saves time and manpower in handling metal too, and freight charges on the small percentage of scrap can be eliminated. Furthermore, the reduction plant has a steady customer and the fabricator has close liaison with his source of supply.

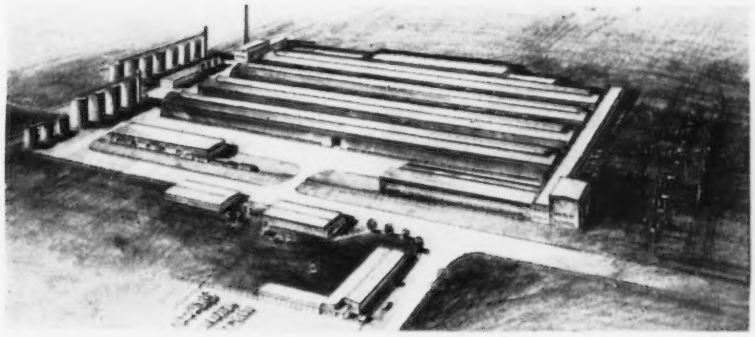
Fabricast has had a chance to test the arrangement over the last three years, and is reported to find it even more satisfactory than first anticipated. The Jones Mills plant was selected for trying the idea of molten metal delivery because space was available and because its location was the most favorable for Fabricast with its home plant in Bedford, Ind., and the outlet for its product in Detroit.

Using half of the Jones Mills rodding room, next to the pot rooms (see photograph). Fabricast setup a small die-casting plant that employed about 250 people on three shifts to produce millions of castings over the three year period.

During this stage of the experiment, Reynolds delivered the aluminum silicon alloy directly to Fabricast's holding furnace. From top to bottom, relations between the two companies remained harmonious, and early this year the plant was started that will make the arrangement permanent.

This idea for two-way, producer-consumer economies was one of many original cost-cutting ideas conceived by Mr. R. S. Reynolds, Sr. At Listerhill, Ala., the Reynolds reduction plant has supplied its own rolling mill molten metal for many years, but application of the idea with an outside customer took a lot of selling. To David P. Reynolds, vice president in marketing, must go credit for working out arrangements with General Motors.

This trend in the aluminum industry should gain momentum as new plants seek to capitalize on the inherent savings of molten metal delivery.



For information about other new plants and expansion projects in aluminum reduction, please see New Projects — Worldwide on page 182.

IN MONTANA
One Plant, Two Precedents

WHEN ANACONDA ALUMINUM CO. broke ground for construction of its important new Columbia Falls reduction plant in June, the event had a double significance. It marked the entrance of an "old line" metal company into the relatively young aluminum business. Secondly, the new plant will be the first in North America to use the much publicized production techniques developed in France.

With several mills of Anaconda Wire & Cable Company and some of the plants of the American Brass Company already fabricating aluminum, the big copper company's venture is a logical development to insure a supply of aluminum. These fabrication subsidiaries will require much of the 50,000 tons of aluminum to be produced per year at Columbia Falls. Part of the output will probably go to the Harvey Machine Company which has a 5% stock interest in the Anaconda Aluminum Company.

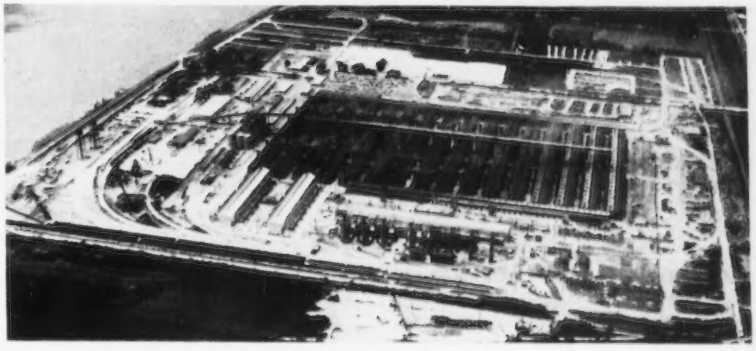
In some circles, this enterprise is regarded as "official recognition" of aluminum's competitive status with copper. Be that as it may, the move is a sound one that augurs well for both the industry and the company.

Plant Design

Anaconda tackled the problem of reduction plant design by making a comprehensive survey of aluminum smelting practice all over the free world. That they obtained the rights and technical data (on a royalty basis) to use the pot design of Pechiney Chemical & Electrometallurgical Products Co. seems to substantiate the French claim to the most advanced techniques in aluminum metallurgy.

Both potlines at Columbia Falls will use large Soderberg anodes of the vertical pin type. Presumably, the lines will consist of the 100,000-amp. pots like those used in Pechiney's Saint-Jean plant (see photograph, p. 129). Reports from several sources claim that these pots consume only about 7.5 kw. hr. per pound of aluminum produced, as compared with 10 kw. hr. required at most reduction plants in North America.

Alumina to feed Columbia Falls will be supplied by Reynolds Metals' Corpus Christi alumina plant. Electric power will come in at 230 kva from the Bonneville Power Administration's transmission line, about 3 mi. away, leading from the Hungry Horse Power Development. The plant is scheduled for completion in late 1954 or early 1955, and will employ about 450 men.



IN LOUISIANA
Biggest U. S. Plant Is Ready

WITH COMPLETION of the eighth and final potline, Kaiser Aluminum and Chemical Corp.'s plant near New Orleans should soon be up to its rated capacity of 200,000 tons per year, which makes it the largest aluminum reduction plant in the U. S.

Built by Kaiser Engineers, the plant will utilize natural gas as its source of power. Reciprocating internal combustion engines of a newer type than those at Alcoa's Point Comfort plant drive the generators for two potlines, while the other six use steam turbines.

Alumina to feed the reduction plant will come from the company's alumina plant at Baton Rouge. Bauxite is shipped there from Kaiser's mines in Jamaica.

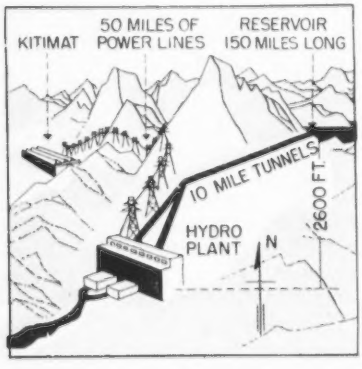
Operation of the first potline began at the close of 1951 with three more being brought in during 1953. By February of this year, six were in production and the seventh was completed in April. Building construction will be completed sometime this fall.

IN BRITISH COLUMBIA

A Giant Is on the Way

WHAT WILL BE THE WORLD'S largest aluminum smelter, is already rising in the sprawling wilderness of British Columbia, 400 mi. north of the U. S. border. Eventual capacity of Aluminum Company of Canada's Kitimat plant (see photo above) will be 500,000 tons a year. Final cost estimates start at $600-million.

Power, of course, is the key factor in the new plant's location, and Kitimat started with the greatest hydro project ever financed by private capital. A watershed, 125 mi. long on a rugged plateau, with heavy rainfall and snowfall was selected despite its difficult accessibility. The waters drained to the east but it was necessary that hydroelectric potential be developed at the western end of the system to take advantage of the half-mile drop to sea level and a smelter site close to ocean transportation. By building a dam at the eastern exit, water will be backed up in a series of lakes and rivers towards the mountain range 125 mi. to the west. Tunnels (10 mi. long, 25 ft. in diameter) driven through the mountains will link the reservoir to a powerhouse built into the base of the mountain.



Water will fall 2,585 ft. through penstocks and pressure conduits in the granite to produce 450,000 hp. in the first phase of the installation. Ultimate capacity will be 2,200,000 hp. of which 1,650,000 hp. will be firm all year around. The power will be transmitted 50 mi. to the smelter as indicated in the sketch at left.

Aluminum production the first year, 1954 or 1955, will be 90,000 tons, with another 90,000 tons capacity to be added the second year. Alumina for the reduction plant will be shipped from Jamaica.

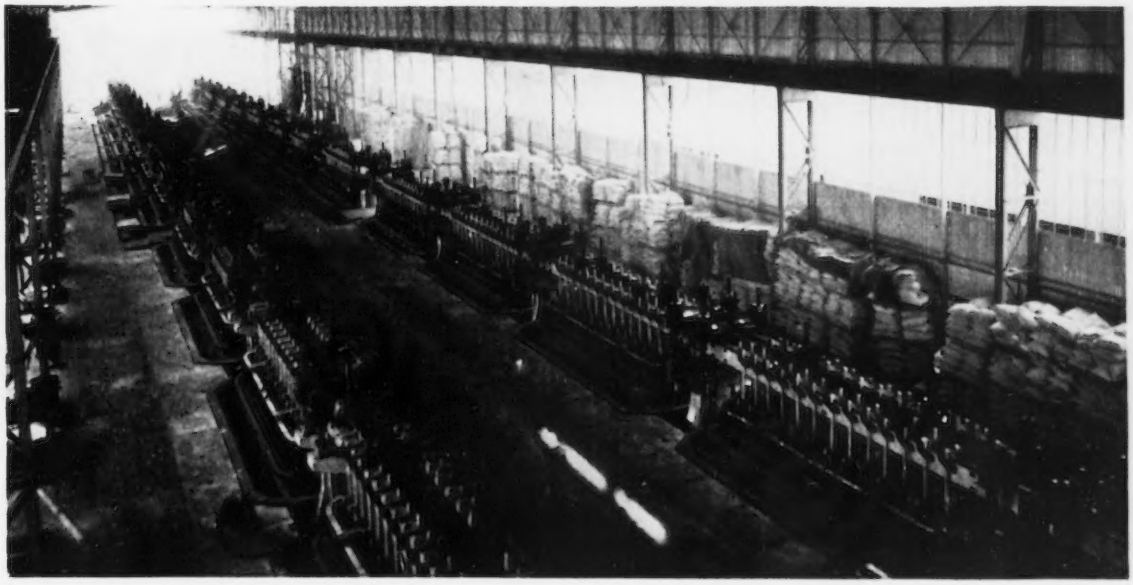
Alcan has engaged expert town planners and architects to help it launch an integrated community on a sound footing. Initially, Kitimat will have a population of about 6,000 of whom 1,000 will be operating staffs for aluminum production. However, basic plans have been developed for an eventual city of 35,000 to 50,000, of whom up to 7,000 will be operating staffs. The remainder will be employees' families, people in local service establishments, and other industries.

IN QUEBEC

Alcan Edges the U. S.

FOUR SMELTERS in Quebec produced 495,000 tons of primary aluminum for Alcan in 1952, about 97% of the output of the parent company, Aluminium Ltd. These smelters have made Alcan the lowest cost producer in North America with a 2 to 4¢ edge per pound over U. S. companies.

Biggest of the smelters, the largest reduction plant in the world is Arvida on the Saguenay River, with a capacity of 354,000 tons per year. Arvida's alumina plant, treating British Guiana bauxite, supplies the other smelters with alumina. At Isle Maligne, just upstream from Arvida, annual capacity is 93,000 tons; at Shawinigan Falls, 61,000 tons. The Beauharnois plant, near Montreal, an uneconomic producer, will probably shut down when its power contract expires this year, subtracting 36,000 tons from Alcan's capacity.



IN FRANCE

Sound Metallurgy For Export

TAKE A GOOD LOOK at the potline above. These are the 100,000-amp. pots at the Saint Jean de Maurienne reduction plant of Pechiney, Cie. de Produits Chimiques et Electrometallurgiques—Pechiney for short. They may well be the most efficient pots in the world, which would explain how Pechiney was able to sell its construction plans to Alcoa, an ingot producer since 1888, and to Anaconda who shopped around a long time before designing its first plant. Saint Jean also operates lines of 55,000, 45,000 and 35,000 amps.

Ten other plants contributed to France's production of about 100,000 short tons of primary aluminum last year. Four were operated by Societe d'Electro-Chimie, d'Electro-Metallurgie et des Acieries Electriques d'Ugine. Pechiney operated Saint Jean and six others. Pechiney, Ugine and a third company also produced 327,000 tons of alumina in 1952. The third company's entire output was exported to Switzerland.

Although bauxite reserves are plentiful in central and southeastern France, producers say that they have reached the limit of electric power available at a reasonable price. To expand they must look overseas. The most important expansion project is a joint Pechiney-Ugine plant to produce 100,000 tons of aluminum annually in French Guiana. No date has yet been set for starting construction.

This ambitious plan reflects the general confidence of French producers in aluminum's future. Industry leaders believe that the aluminum price, 51¢ a kilogram (2.2 lb.), is adequate, and look for rapid expansion of markets in construction and transportation.

IN USSR

German Plants, Hungarian Ore

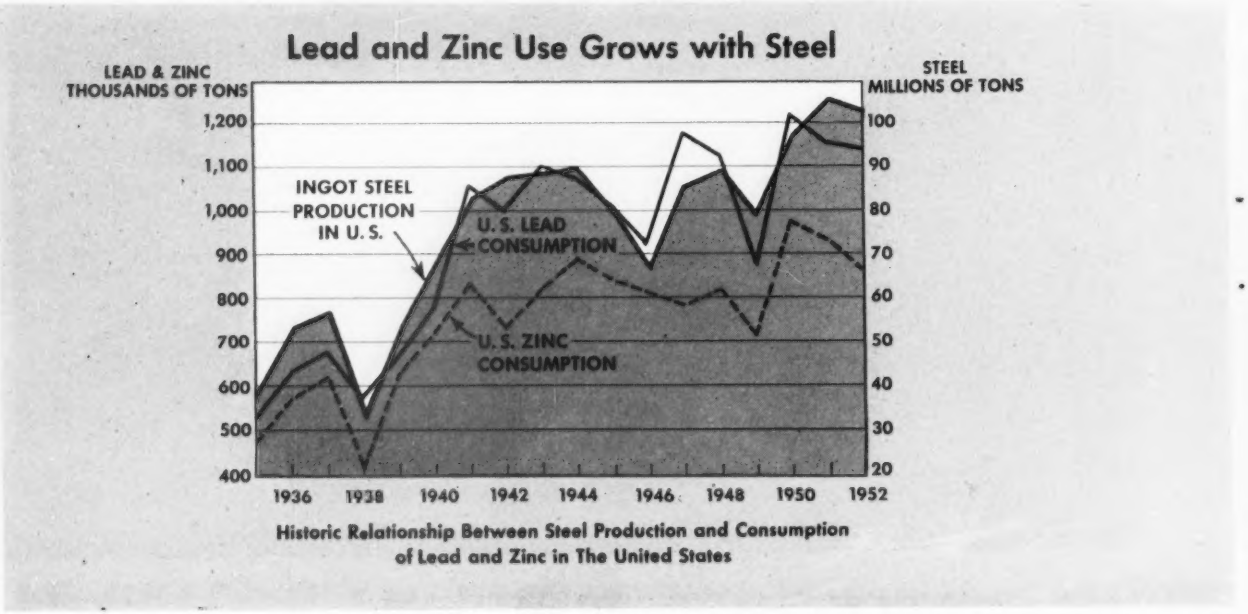
PRIMARY ALUMINUM production in the USSR quadrupled between 1946 and 1952 when it reached 330,000 tons. This growth was aided by plants stripped from Germany and by bauxite from Hungary.

Bauxite reserves in Russia were estimated in 1942 at 50-million tons, containing 11.5-million tons of aluminum. However, reports on Soviet smelting practice indicate that only about 45% of the aluminum content was recovered from high grade ore of the Northern Urals, and about 30% from low grade deposits at Tikhvin. Later reports indicate recovery has improved, but how much is not clear.

The largest of the USSR's six smelters, with 83,000 ton capacity, is at Kamensk in the Urals. Another 83,000-ton plant is under construction in Armenia and a large expansion is planned at Lake Balkash.

In addition to its own production in 1952, USSR imports, largely from Hungary, and new scrap brought the Soviet supply to a guesstimated 380,000 tons, about 36% of the U. S. supply. Meager evidence indicates that only about 5% of the USSR supply went in consumer goods. Since only 30% of the U. S. supply went to the military, the U. S. used slightly more aluminum for defense. This edge, however, is nullified by the fact that Russian planes require considerably less aluminum per hour flying time. However, in 1952, Canada and the U. S. produced about four times as much aluminum as the Iron Curtain and expansion plans in both areas will probably keep this proportion constant.

LEAD & ZINC



Historic Relationship Between Steel Production and Consumption of Lead and Zinc in The United States

MARKET ANALYSTS, appraising the outlook for lead and zinc have often pointed to the close relationship between consumption of steel, and of lead and zinc. (See graph above.) Since 45 to 50% of the lead used today goes into products used in the automobile and a similar proportion of zinc is consumed in galvanizing, the acceptance of steel as an indicator of metal consumption is logical. The next question is "Where is steel heading?" H. S. Harrison, vice president of Cleveland-Cliffs Iron Co., estimates that the steel ingot capacity in the U. S. will rise from the 104-million-ton level of 1951 to about 125-million by 1960. Now assuming that the relationship shown in the above graph continues, the conclusion is obvious—the forward-looking expansion programs now under way in the world lead and zinc industry are well justified.

But the apparent tie between steel, and lead and zinc consumption is by no means automatic. If research had not evolved high-purity zinc and alloys for die casting, and if tetraethyl lead had not been developed for gasoline, both the lead and zinc curves would have sagged considerably below the positions shown in the graph above. This indicates that current expansion programs for the production of lead and zinc should be paralleled by accelerated research and market development, particularly because the threat of substitutions today is pronounced.

Here are two views recently expressed at the meeting of the American Zinc Institute:

"We feel that new markets for zinc-coated steels will far more than offset the markets that this industry **should logically lose to competition**. . . . To do this . . . men in research and production must continually produce improved zinc-coated steels and at the same time make big strides in economy of production."—B. P. Finkbone, product engineer, Armco Steel Corp.

"If zinc is to continue to make good headway in Europe and all over the world, our efforts must at least match those made on behalf of the new metals, whose producers are often the main consumers, and so can more readily appreciate the value of expenditure on market research and development work."—R. L. Stubbs, director, Zinc Development Association, Oxford, England.

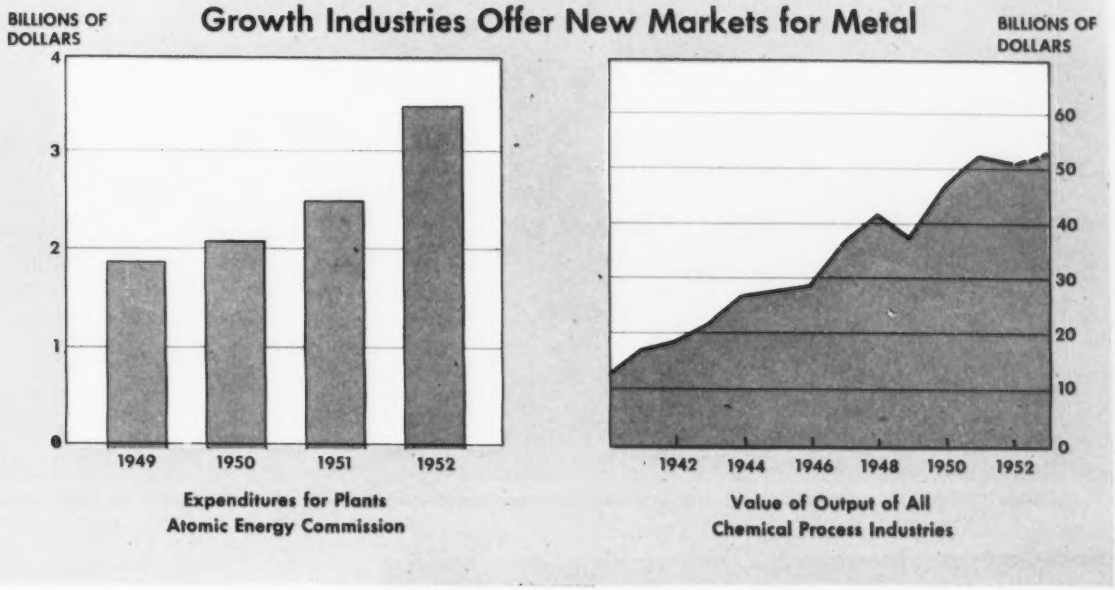
Both the Lead Industries Association and American Zinc Institute are doing a commendable job of promoting research and market development. In addition various companies are doing outstanding work in the same direction. Here are a few examples:

National Lead Co. set up a laboratory in 1891 to establish standards for uniformity and purity for white leads used in paint. From this initial service to assure customers of uniform high-quality products, the company's research and development program has grown constantly. In 1952 the company spent several million dollars on research. Through this pro-

What Research Did For Lead

Development of tetraethyl lead for use in gasoline resulted in the following demand for lead:

Year	Short tons
1942	48,800
1943	60,300
1944	85,200
1945	75,900
1946	48,000
1947	66,600
1948	83,800
1949	101,700
1950	111,100
1951	128,407
1952	146,723



gram, the company has developed 12 lead compounds that serve as stabilizers against light and heat in polyvinyl resins. Note that the current annual output of polyvinyls is 400-million lb., and that this output could easily soar to 1-billion lb. within a decade or less. Lead constitutes 1½ to 2½% of the weight of polyvinyls using lead stabilizers. In addition National Lead has developed more than 100 new lead compounds and is seeking to develop markets for them.

New Jersey Zinc Co.'s pioneering research and market development of high purity zinc and alloys for die casting has had a profound effect on the progress of the zinc industry, and has started the metal working industry on its way as a high-speed producer of metal parts. Zinc consumption for die casting in the mid twenties (when New Jersey started its program) was only about 13,000 tons. Today it is about a quarter of a millions tons per year.

Where will the future new markets for lead and zinc lie? One answer is the growth industries. For instance, the polyvinyl and plastic industry, mentioned previously, is a new market for lead. It could absorb many tons of lead a year, and this is but a small part of the chemical industry which is now expanding to fantastic levels. (See graph at top of page.) In Europe the growth of the plastics industry is expected to be even more meteoric.

Another growth industry indicated in the graph above is the atomic energy industry. We are now on the verge of a great transition from the production of atomic energy and products for defense purposes to production for long-term peacetime applications, and it is not too early to appraise this field for possible uses of lead. As of now, it is known that fair quantities of lead are used for shielding in reactors, possibly for liquid coolants, and particularly for shielding isotopes which are now being transported and used in increasing numbers. AEC announces that about 35,000 shipments of isotopes have been made to domestic and foreign users in 1952. Many of these have to be shielded with lead in transit. For instance, Battelle Institute reports that it requires 300 lb. of lead shielding to house Cobalt-60. If atomic power for mobile units such as ships and submarines develops to major proportions, lead will be in substantial demand.

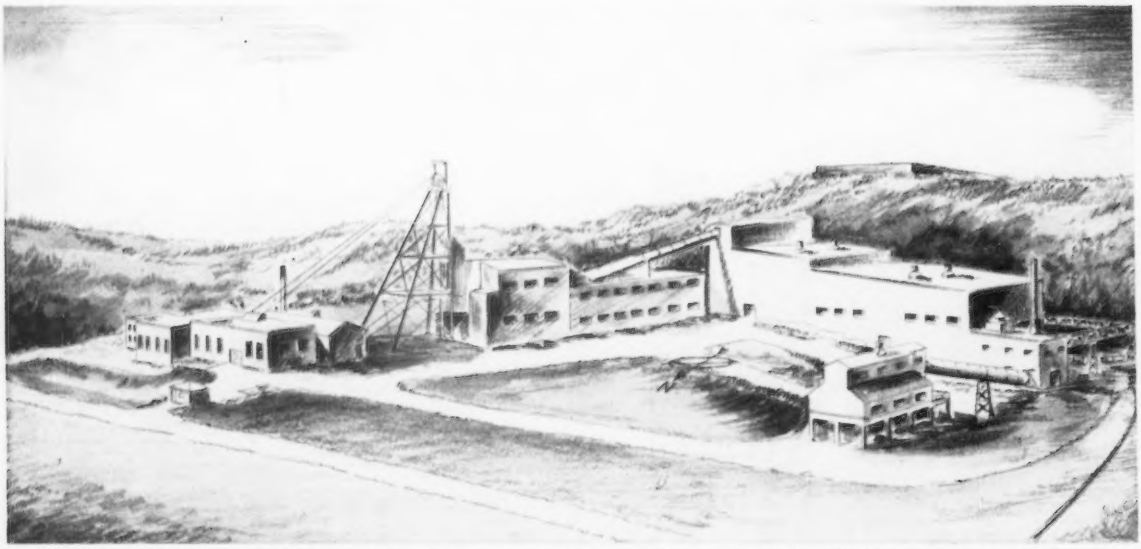
A new high-voltage, low-energy battery, devised for electronic units derives its power entirely from radiation from isotopes. But it must be shielded, and lead is the shielding material used. It is possible that many thousands of these batteries will be used.

For zinc, renewed interest in anodic protection of metals offers an attractive market. If the thousands of pounds of zinc used to protect pipelines for one city in the USA is extrapolated into the thousands of tons that would be required if all cities used zinc to protect pipelines, the market for zinc would be greatly stimulated.

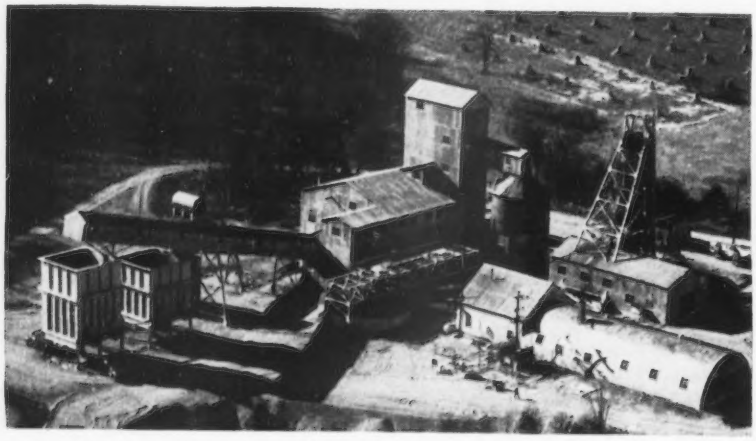
What Research Did For Zinc

Development of new and improved high-purity alloys resulted in the following demand for zinc:

Year	Short tons
1943	76,300
1944	84,500
1945	130,800
1946	212,211
1947	214,469
1948	234,628
1949	202,181
1950	289,527
1951	266,442
1952	236,022
1953 (est.)	285,000



AT INDIAN CREEK, a model mine and mill are now nearing completion. Capacity of the mill will be 2,000 tons.



AT HAYDEN CREEK, a 2,000-ton Sink-and-Float plant treats mine ore.

St. Joseph Lead Co. . . . .

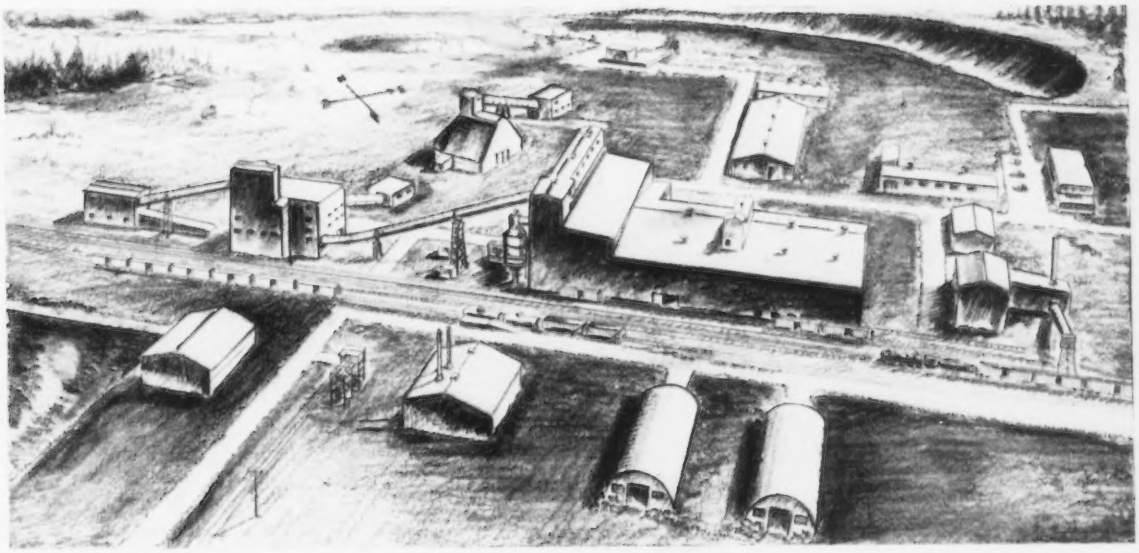
. . proves that old producing areas can be the target for new mineral finds.

SOUTHEAST MISSOURI has produced much of the nation's lead for more than 100 years, and yet this famous old district can boast of these two sizable new mines, now being brought into production by the St. Joseph Lead Co.

1. The Hayden Creek Project. This unique orebody, discovered by diamond drilling, occurs as a conglomerate of granite boulders cemented by dolomite. The lead, as galena, is disseminated throughout the dolomitic matrix. Ore is mined by a room-and-pillar system with such modern equipment as continuous loaders, cable-reel shuttle cars, and Tournarockers. After being crushed underground, ore is hoisted through a 700-ft. shaft to a 2,000-ton secondary crushing and Sink-and-Float plant which discards about 50% of the mine output as waste. The balance, an up-graded lead product, is trucked to the company's Leadwood mill for further concentration. Grade of mine ore is about 3%. Expenditures involved in this project, including mine and surface plant, total approximately $1.4-million.

2. Indian Creek Project. Still under construction, this new 2,000-ton operation promises to become a model mine. The present circular shaft has been sunk and concreted to a final 950-ft. depth without a single lost-time accident—all of this accomplished by "country boys" who were trained by St. Joe's ingenious staff, under the direction of C. Kremer Bain.

The orebody is similar to other Lead Belt deposits, consisting of disseminated galena and sphalerite in altered dolomite. Present plans call for room-and-pillar mining methods using mobile drill jumbos, electric shuttle cars, and mobile slusher ramps. Hoisted ore will go through a primary and secondary crushing plant, a primary rod-mill in open circuit and a secondary ball-mill section in closed circuit with classifiers and Denver jigs. Classified pulp will go through lead and zinc flotation circuits in series, and thence to a concentrate filtering-drying-storage section. Cost of the plant and related facilities will be approximately $5½-million. Design of the plant is such that it can be readily enlarged if found desirable.



ZINC ORE MOVES from open pit in background, through primary and secondary crushers at left to 4,000-ton mill.

Barvue Mines, Limited . . . . .

. . opens up Canada's newest major open-pit zinc deposit.

BARVUE'S NEW PIT was stripped hydraulically at low cost.

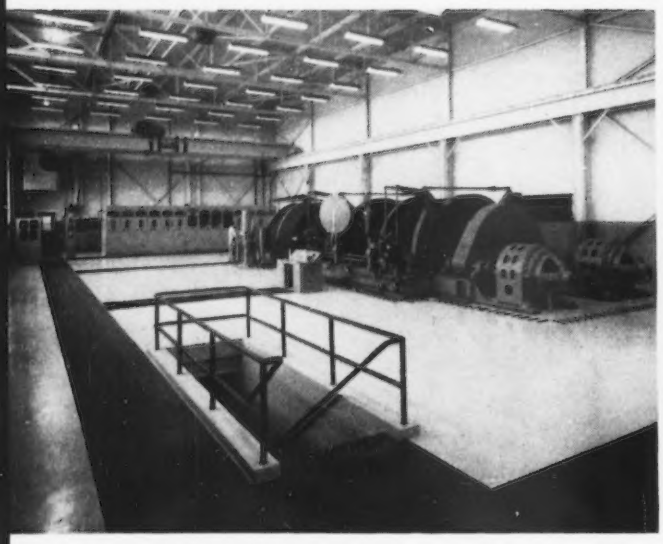
BARVUE MINES, LTD., made Canadian mining history last year, when it opened up its new 14.3-million-ton zinc orebody near Barraute, Quebec. Speed of development has been amazing. The orebody was discovered as recently as 1950 by W. W. Weber, geologist for the Quebec Department of Mines; diamond drilling started in 1951; first concrete for the new plant was poured on Jan. 10, 1952; and by October the mill was turning out concentrates. Today the mill handles about 4,000 tons of ore per day, yielding 200 tons of 60% concentrates. Average grade of ore in the pit is 3.3% zinc, 1.1 oz. silver, and 5 to 6% pyrite.

Open-pit stripping costs were slashed from an estimated $2.25 per yard by truck-and-shovel methods to 35¢ per yard by hydraulic monitors. Other equipment in the pit includes I-R Quarrymasters, 22-ton Euclid trucks and 2½-yd. Link-Belt Speeder shovels.

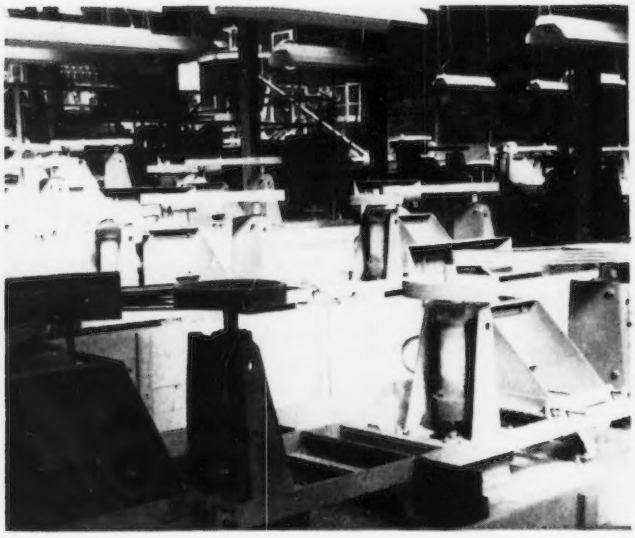
General Engineering Co. designed the modern surface plant in cooperation with Barvue's competent metallurgical staff which knew what it wanted from experience by way of a model mill. The plant incorporates such features as an underground crushing plant, tubular conveyor galleries housing fluid-drive belts, catenary steel ore bins, Hardinge Tricone ball mills equipped with Micarta water-cooled bearings and fluid drive, a Drago lime-storage system, and Agitair and Denver Sub-A flotation cells. Mill capacity can be increased to 6,000 tons if required. Plant buildings are connected by 2,350 ft. of concrete tunnels—an important convenience for rough winters.

The Barvue discovery has attracted many exploration teams to the Barraute area, and it is unquestionably one of the significant forward steps in the development of Canada's mineral resources. Credit for accomplishment goes to Barvue's dynamic general manager, Andy Robertson, and his associates—including Doug Isbister, mine manager, A. A. Almstrom, mill superintendent, and Dave Livingstone, consulting metallurgist. H. W. Knight is president of Barvue Mines, Ltd. Cost of the project is about $10.5-million.

Plant drawings, pages 132 and 133, courtesy General Engineering Co., Toronto.



NEW HOISTS installed at Friedensville project.



FLOTATION SECTION of revamped Austinville mill.

New Jersey Zinc Co.

Expansion program involves mines, mills and smelter.

PALMERTON. New Jersey Zinc Co.'s $10-million modernization program at the Palmerton smelter has been under way for the past four and one-half years. Principal projects in this continuing program included a new roasting, sintering and acid plant, and a new battery of slab zinc vertical furnaces. Special type condensers, recently invented by the company, have improved production of high-purity slab zinc.

Plans for the year include construction of a new fume collection plant to recover additional metal values, installation of autogenous cokers for slab zinc production, and numerous materials-handling modifications including dieselized interplant railroad and crane facilities. A new traveling-grate furnace for production of zinc oxide has been installed, and more of the same type will be added.

Friedensville. A few miles south of Bethlehem, Pa., New Jersey Zinc Co. is readying a 100-year-old property for renewed production after a half century of idleness. Difficult hydrological problems slowed development, but it is now believed that production will start in late 1954 or in 1955. A new shaft has been sunk to the planned 1,260-ft. depth. Pumping to dewater areas outside of the grout-protected shaft is now under way to permit further development. Erection of the 200-ton, 130-ft. headframe was unusual. The structure was erected on a site 30 ft. from the shaft, and then moved into place over the collar with block and tackle. Engineers said that this technique saved five weeks of installation time. Surface buildings completed include 25 homes, a hoisthouse and other facilities. A 2,400-ton mill is scheduled to be constructed in 1954.

Austinville. The flotation plant at Austinville, Va., has been completely modernized, and capacity increased by about 30% to 2,400 tons per day to offset in part rising unit operating costs due to the lower grade of ore mined. Much of the old mill equipment has been discarded. New equipment installed includes: 72 56-in. Fagergren flotation cells as roughers, and 24 No. 21 Denver cells as cleaners; added conditioning units ahead of the zinc flotation section; and rubber-lined pumps. Two new 8 x 12-ft. Marcy rod mills, two new 8-2-4-7 Hardinge Tricone ball mills, and two Wemco spiral classifiers have increased capacity, and decreased maintenance and power consumption per ton of ore ground. Mills are arranged in two 2-stage units with a rod mill in open circuit delivering pulp to a classifier in closed circuit with a ball mill. Two old gryatory crushers were replaced with two 3-ft. Symons crushers.

Ivanhoe. New Jersey Zinc Co. is developing a new mine at Ivanhoe, Va., to provide additional zinc ore for the nearby Austinville mill. Production is expected to start in 1955. A vertical shaft has been completed to 1,050 ft. Shaft stations for nine levels were turned off during shaft sinking. Excavation of underground stations and level driving are the next steps to be undertaken. The Van Mater shaft at Austinville will be connected with the new Ivanhoe shaft by a 13,300-ft. tunnel on the 1,100 level. About 1,000 ft. has been driven from the Austinville side. A tunnel will also be driven from the Ivanhoe side. A permanent power line, transformer station, steel headframe, and hoisthouse are scheduled for erection this summer. Work is currently under way on the hoist foundations. The completed hoist building will house a mine office, change house, dispensary, compressors, lamp room, and machine shop. Completion of the headframe and hoisthouse is scheduled to coincide with delivery of equipment to develop the mine.

SELBY ZINC-FUMING plant started up April, 1953.

ELECTROLYTIC ZINC plant enlarged at Corpus Christi.

ASARCO

New zinc fuming plant and mine expansion enhance company's position in metal field.

AMERICAN SMELTING AND REFINING CO.'S new Selby slag-fuming plant started operation on April 21, 1953. This plant has a capacity for the treatment of 350 tons of blast-furnace slag daily (250 tons of hot slag from current smelting operations plus 100 tons of cold slag mined from the slag dump). Output of the plant will be about 13,500 tons per year of deleaded, densified zinc fume assaying approximately 77% Zn, less than 1% Pb. This is equivalent to about 10,400 tons of zinc metal per year.

The Selby plant does not include waste-heat recovery or power generating equipment. Furnace width is standard—8 ft., but because of the smaller tonnage of slag available, it is only 12 ft. long, versus 21 ft. at ASARCO's El Paso and Chihuahua installations. The Utah coal used for fuel is unloaded in a track hopper, crushed to minus ¾-in. in a Jeffrey crusher, and pulverized in B&W coal pulverizers. Coal requirements approximate 50 to 55 tons per day. Furnace air requirements are supplied by an electrically-driven blower with a capacity of 10,000 cfm at 14 lb. pressure.

The 8x12x24-ft. furnace is completely water jacketed, as is the offtake flue to the spray chamber. From the spray chamber, the furnace gas passes through a long steel balloon flue to the U-tube coolers followed by Labbe coolers, thence to the baghouse consisting of 400 18-in. x 30-ft. bags divided into five chambers. The baghouse product is conveyed to a surge bin feeding the 7x75-ft. gas-fired rotary kiln where the zinc fume is densified and deleaded to a shipping product containing 77-78% Zn, 0.5-1% Pb. The deleaded zinc fume leaving the rotary kiln is cooled in a Traylor tube cooler, screened and crushed to minus ¼-in. for shipment to midwestern retort smelters.

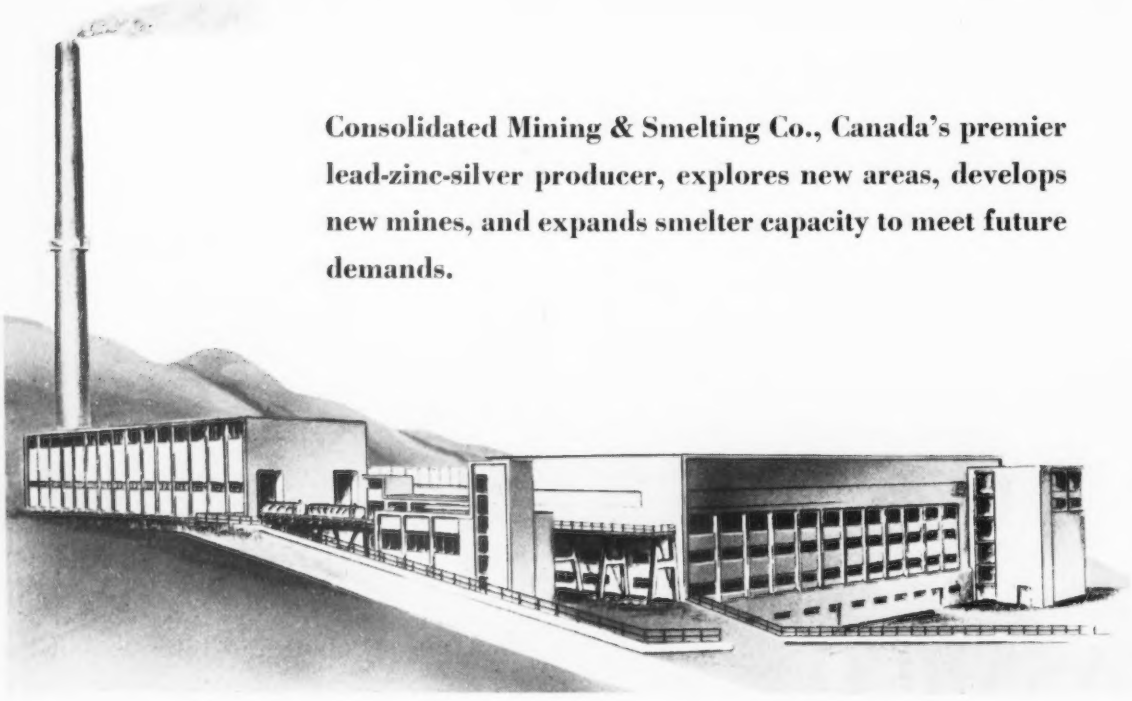
The expansion program involving additional power facilities at the Corpus Christi, Texas, electrolytic zinc plant proceeded on schedule, with initial operation at the higher capacity of 5,000 tons of electrolytic zinc monthly slated for June 1953. New facilities at Corpus Christi will permit treatment of zinc oxide fume from the company's zinc-fuming plants elsewhere.

At Chihuahua, Mexico, ASARCO's newly completed plant for the production of zinc fume from lead blast-furnace slag was started up during the last two months of 1952. Production is at the annual rate of 23,000 tons of zinc contained in fume.

ASARCO's mine expansion program includes the new 1,000-ton-a-day Van Stone open-pit mine near Northport, Wash. which started up during October 1952 (See *E&MJ*, April, 1953). Ore averaging 3½-4% combined lead and zinc is treated in a 1,000-ton flotation plant to produce lead and zinc concentrates.

At Chilete, Peru, a new 250-ton lead-zinc flotation mill was started up in May 1952 by Northern Peru Mining and Smelting Co., subsidiary of ASARCO. Other construction involved in bringing this property into production included a 770-kw. diesel power plant, machine shop, research laboratory, warehouse, general and engineering office, repair garage, carpenter shop, community section to house 252 workers, public sanitary facilities, a school for 350 children, company store, restaurant, community center, hospital, police station, public market, football field, basketball field, 10 residential houses, a large staff house—in short not only mining and milling plants but complete facilities for the community as well. Investment here is reported to have totaled $3-million.

At the Nuestra Senora lead-zinc-silver property in Mexico, construction of the mine surface plant, power plant, mill, and townsite is in progress with ore production scheduled to start at a rate of 12,000 tons per month by late 1953.



Consolidated Mining & Smelting Co., Canada's premier lead-zinc-silver producer, explores new areas, develops new mines, and expands smelter capacity to meet future demands.

NEW SINTER PLANT (right) nears completion; concentrate storage building (left) will be next step in program.

COMINCO Enlarges Trail Plant

COMINCO'S forward-looking mineral expansion program has resulted in the development of two important base-metal mines: (1) Tulsequah, B. C., where operation of a lead-zinc mine was started in 1951 at a 300-ton daily rate in 1951, and increased to a 500-ton daily rate in early 1953. (2) The Bluebell mine at Riondel, on Kootenay Lake, which was brought into production in April 1952. Lead-zinc concentrates from the new 500-ton mill at this property are shipped to Trail for smelting.

A third property, the H. B., at Salmo, B. C., which is equipped with a 1,000-ton concentrator, awaits favorable market conditions before it will start producing.

A significant exploration program is now under way at Pine Point, on the south shore of Great Slave Lake, where Cominco has staked a favorable mineralized belt extending for 36 miles. Active exploration started in 1948, and today several million tons of ore are indicated, about half of which is minable by open-pit methods. Exploration continues in this area.

The Sullivan mine at Kimberly continues to be the company's major producer. In 1951 Cominco started production by open-pit methods of a section of the orebody adjacent to the outcrop of the main Sullivan deposit, and currently about one third of the mine's daily production comes from this operation.

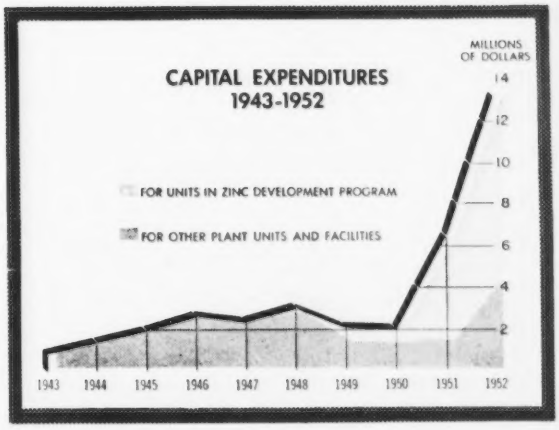
Cominco's major modernization program at the Trail lead smelter started in 1948. Plans called for the continued operation of the smelter while changes were being made. Accordingly, the first unit to be installed was a 300,000-cfm baghouse for recovery of 100 tons of metal-bearing dust daily. Next step was the construction of a new feed preparation and sintering plant (see illustration above). This plant is nearing completion, and tests are currently being made on 10x60-ft. sintering machines. These sintering machines are being installed, one to handle first-pass sinter, one to handle second-pass sinter, and a third as a standby unit.

An interesting metallurgical technique is Cominco's development of a new machine for the production of starting sheets for the electrolytic lead refinery. Costs are considerably lower with this machine than with former hand-casting methods. The machine utilizes a water-cooled roller rotating in contact with the surface of a bath of molten lead to produce a continuous lead sheet about 1/16-in. thick and 27-in. wide. The continuous strip is automatically cut into sheets of correct size for use in electrolytic lead cells.

A second project at Trail was the 66-ton addition to the electrolytic zinc plant, which brings the capacity of the Trail plant to more than 500 tons of slab zinc daily. This involved the installation of three 5,600-kw mercury-arc rectifiers. Also in connection with this project, Cominco is installing a 300-ton induction furnace, one of the largest of its type in the world, and an automatic casting machine for slab zinc. The furnace is scheduled to come into production late this spring, and the casting equipment by the end of the summer of 1953.

The foregoing projects plus others for power and fertilizer, round out Cominco's $65-million program.

Cerro de Pasco Expands Zinc Capacity



CERRO DE PASCO'S zinc development program started in 1948 is making good progress. The program embraces a two-stage expansion of concentrating facilities at Paragsha; the construction of a 35-ton electrolytic zinc refinery, now in operation; an electrothermic zinc plant with ultimate capacity of 200 tons of slab zinc a day; the addition of a generating unit to the hydro-electric plant at Malpaso; and the construction of a new 72,000-kva hydro-electric plant on the Paucartambo River.

The first stage of expansion at the Paragsha concentrator which increases capacity from about 700 to 1,000 short tons of lead-zinc ore per day was virtually completed by the end of 1952; the second stage is scheduled to begin operation before mid-1953. It will be used to concentrate 600 tons of copper ore per day initially, and later converted to treat lead-zinc ores. The 35-ton electrolytic zinc plant started up late in 1951. The first 35-ton unit of the Sterling Process electrothermic zinc plant is scheduled to start production in the third quarter of this year, and a second 35-ton unit early in 1954.

The transmission line and access roads to the Paucartambo power project are virtually complete, and driving of the main tunnel is well under way. Total cost of the corporation's zinc development program is estimated to be $44-million, of which $21-million was expended by the end of the first quarter of 1953. The remaining $23-million will be expended by 1957.

Additional Modernization or Expansion Projects in Lead-Zinc Industry

Company and Location	Project	Starting Date
American Zinc Co.		
North Friends Sta., Tenn.	Developing large zinc property	Future
Quick Seven Mine, Mo.	2,000-ton lead-zinc open pit	1953
	2,000-ton lead-zinc mill	1953
Anaconda Copper Mining Co.	Sixth elecrolytic zinc section installed	Early
Great Falls, Mont.		1953
Hecla-Atlas Project	Large deep-level exploration in lead-zinc zone under way	Future
East Silver Belt, Idaho		
St. Joseph Lead Co.		
Herculaneum, Mo.	20 ton/day zinc furnace	1954
	Lead smelter capacity to be increased to 100,000 ton/yr.	1954
Josephtown, Pa.	Capacity of zinc plant increased to 120,000 ton/yr.	1952
Vulcan Silver Lead, Idaho	Developing new lead-silver mine	Future
Brunswick Mining & Smelting	Planning 3-5,000-ton lead-zinc open-pit mine, and mill	Future
New Brunswick, Can.		
Austria, Bleiburg	10,000-ton electrolytic zinc plant	1954?
France, Compagnie Royale	New 20,000-ton vertical zinc retort	1953
Asturienne des Mines		
Italy, Project in	Electrolytic zinc refinery expanding capacity to 16,000 ton	Future
Bergamo area		
Yugoslavia, Sabac	20,000-ton electrolytic zinc plant	1954
North Africa, Societe Nord-	1,000-ton lead-zinc mine	1954
Africaine du Plomb	1,000-ton lead-zinc mine	1954
South West Africa	Copper, lead and zinc output to be increased to 85,000 ton/yr.	1954
Tsumeb Corp., Ltd.		
Belgian Congo, Union	40,000-ton electrolytic zinc plant	1953
Minere du Haut Katanga		
Tanganyika Territory	1,000-ton lead-copper mill and mine planned	1954
Uruwira Mpanda Project		

Virtually every major mining company will soon be in the uranium business in one way or another.

WORLDWIDE URANIUM BOOM has been set off by short-range demands for defense, and long-range promise of atomic power for peacetime uses.

Two Outlook Factors

URANIUM'S FUTURE depends upon two developments: (1) Continued requirements for a stockpile of weapons to guarantee non-aggression in the free world, and (2) gradual conversion of uranium use to the production of atomic power as the stockpile goals are met.

1. While the urgent need of uranium for military purposes still persists, there are indications that progress is being made. It has been reliably reported that AEC's stockpile goals are "in sight," which could mean production of weapon materials for another 10 years. Atomic weapons are being produced so fast that more space is being sought to store them. In addition some $200-million is being spent in the current fiscal year for the production of thermonuclear materials (probably H-bomb devices). During the past 12 months construction of an atomic-powered submarine has been started and another planned, more powerful A-bombs have been set off experimentally, and the first atomic shell has been fired by a cannon. But since the Soviet Union has given "highest priority" to its atomic program, Gordon Dean, chairman of the U. S. Atomic Energy Commission, told Congressional members recently, "I think 1954 is going to be a very important year in our program, and I tremble to think that we might slacken off."

2. Assuming that the need for weapons will slacken off in time, mining men will naturally want to know if the world uranium program will collapse. Not according to AEC Commissioner Henry D. Smyth, who told mining men last September, "It is my own belief that the use of uranium for power purposes will become economically feasible before the need for uranium for military purposes begins to slack off. Therefore I believe that there is going to be a continuing demand for uranium."

Technical milestones in the development of atomic power have been listed recently by Gordon Dean as follows:

Dec. 2, 1942. First successful operation of a nuclear chain reactor by Dr. Fermi and his staff at Chicago.

Dec. 1951. First successful production of useful atomic power in the AEC's Idaho breeder reactor.

Summer, 1952. Four study teams composed of outstanding private firms such as Detroit Edison, Dow Chemical, Commonwealth Edison, Bechtel Corp., and others reviewed AEC's reactor development program, and not one of the teams "was pessimistic so far as the ultimate practicability of atomic power is concerned."

Early 1953. The prototype of the first atomic power plant for submarines began operating in Idaho.

June 4, 1953. Dr. Zinn and Dr. Lichtenberger of Argonne National Laboratory reported, that the reactor has demonstrated the principle of breeding.

Mr. Dean cautioned, that while breeding would greatly enhance the long-range outlook possibilities of atomic power production, "our great current demand for U-235 and plutonium for weapons, and our equally great need for uranium ore to meet this demand, will not be lessened by one iota!"

The time when commercial atomic power will be economically feasible has been set at 5 to 20 years depending on who makes the estimate. North American Aviation claims to have full designs for a plant and offers to build it for $10-million right now. The four study teams mentioned previously appear to have several ideas on how an atomic power plant can be best designed, and cost estimates run from $50 to

URANIUM

Partial List of U.S. Mining Companies Active in the Uranium Industry

American Smelting & Refining Co.
Anaconda Copper Mining Co.
Barkley Mining Co.
Bunker Hill and Sullivan Mining and Concentrating Co. (E)
Climax Uranium Co.
Consolidated Uranium Co.
Dulaney Mining Co.
Edgemont Mining Co.
Excalibur Mining Co.
Golden Cycle Mining Co.
Haystack Mountain Development Co. (Subsidiary Santa Fe. RR.)
Homestake Mining Co.
Jenkins and Hand
International Minerals and Chemical Corp.
Kerr-McGee Oil, Inc.
LaSal Mining Co.
Livingston Mining Co.
Minerals Engineering Co.
Navaho Uranium Co.
Plateau Mines, Inc.
Shattuck-Denn Mining Co.
Skidmore Mining Co.
J. R. Simplot Co.
Sunshine Mining Co. (E)
Sodak Mining Co.
U. S. Vanadium Co.
Uranium Co. of America
Utex Uranium Co.
Vanadium Corporation of America
Vitro Chemical Co.
Western Gold Mines
White Canyon Mining Co.
(E) Exploration projects.

Active and Potential Uranium Producers in South Africa

Mining Company	Approximate Monthly Capacity of Mill	Start of Production
Daggafontein (A)	70,000	May 1953
Vogelstruisbult	40,000	Mid 1954
Luipaardsvlei	40,000	1954
West Rand Consolidated (A)	40,000	1952
Randfontein (A) / East Champ d'Or	100,000	1954
Blyvooruitzicht	160,000	1953
Stilfontein (A)	60,000	1953
(Will also treat Ellaton G. M., Afrikander Lease, Barbrosco Mines New Klerksdorp)		
Western Reefs (A)	140,000	1953
Welkom / Western Holdings / Free State Geduld	100,000	1954
President Steyn / President Brand	100,000	1955
Virginia (A)	50,000	1955
Harmony	45,000	1955

Companies marked with (A) will be equipped with sulphuric acid plants. Other potential producers are Merriespruit, Doornfontein, Vaal Reefs, St. Helena, Freddies North, Freddies South, Loraine, Jeannet, and Sub Nigel.

$150-million. Some private firms ask for immediate relaxation of government laws which now prohibit possession of fissionable materials by industry and outlaw atomic power production by such interests. However, legislation now pending is aimed at relaxing these restrictions where possible. Chairman Dean of the AEC summed the situation up this way, "In my opinion, the next five years are developmental years—years in which we will be working toward realization of economically feasible atomic power, not enjoying its fruits."

Atomic Power for Mining

Several possible uses of atomic power in the mining field have been appraised in a recent book, *Economic Aspects of Atomic Power*, by Schurr and Marschak. With certain reservations, the conclusions mentioned in brief below are receiving serious consideration by industry members:

1. **Hydrogen reduction for ores and steel.** The favorable cost of hydrogen reduction using atomic energy might provide a promising alternative for expanding steel output in underdeveloped areas.

2. **Phosphate fertilizers.** For low-grade phosphorites, atomic power might offer important advantages through possible reductions of power costs.

3. **Aluminum.** "Our tentative conclusion is that atomic power would be more likely to reduce aluminum costs in France, Germany, and the U. K., than in the United States, Canada, Norway, Japan . . . [and elsewhere]."

Worldwide interest in the development of atomic power is so intense today, that progress must surely be accelerated—What one nation fails to discover, another might. Here are some significant recent digests from world news sources:

Sweden's first atomic reactor, a 100-kw. unit, will use four to five tons of uranium derived from shale.

Ten European nations are discussing plans for a £13-million Nuclear Research Center to be established in Switzerland for work on non-military applications.

J. H. Viljoen, South Africa's Minister of Mines, is reported as having said that part of the local uranium production would be used for atomic research.

Australian articles report that since the use of uranium for fuel appears to be 10 years away it is logical to ship current uranium production for defense purposes.

"Brazil Sees Power from the Atom by '58" says a New York Times headline. A $5-million power reactor at Belo Horizonte is planned.

India views her thorium and uranium resources with a great deal of hope for domestic power.

In Britain, 80 offices at the Atomic Energy Research Establishment, at Harwell, have been heated by BEPO, the large experimental pile.

Canada's Chalk River reactor is evidence of that nation's interest in peacetime uses of uranium.

Progress in world atomic energy programs may create important demands for collateral materials such as beryllium, lead, cadmium, aluminum, graphite, tungsten, zirconium, lithium (in thermonuclear work), stainless steel, liquid metals and possibly mercury.

In summary, the current and future uranium exploration and production programs now under way in many parts of the world are justified by the current need for uranium for defense purposes, and the long-range peacetime possibilities of economic atomic power. Cost of these projects may easily run in several hundred million dollars. See following pages.

In the United States

PRODUCTION from the vast Colorado Plateau (left), still the largest domestic source of uranium, is exceeded only by that from the Belgian Congo. Output has been stimulated because this area has been the scene of the greatest organized exploration program in history. Drilling footage sponsored by the Government on the Plateau has been about 960,000 ft. in 1952. The Government plans to increase this by about 10% in 1953, and it is estimated that private drilling will be twice the footage the Government plans. Number of mills operating on the Plateau has been increased from two in 1948 to nine operating today, with two more expected to start in the near future. Output from the Plateau during the first quarter of 1953 has been about double that for the first quarter of 1952.

In the Black Hills, S. D., a new "Plateau" development is under way. Ore shipments are received at Edgemont from three major and a number of small uranium producers.

In Canada

ELDORADO MINING and Refining Co. is Canada's only current producer of uranium, with output coming from the well-established Port Radium properties on Great Bear Lake NWT, and new production from the Beaverlodge properties northeast of Lake Athabaska. Here a 500-ton mill will treat ores coming from two shafts, the Ace and Fay, connected by a 4,000-ft. tunnel (see photo at right) driven at 800 ft. Should production warrant, the capacity of the mill can readily be increased to 2,000 tons. Cost of the Beaverlodge project is estimated at $17-million. Initial discoveries of uranium in the Beaverlodge area resulted in Saskatchewan's greatest staking rush, and what the results will be are not clear at this time. Step-by-step exploration progress reports are plentiful but as yet tonnages and grade are obscure. Among those properties reporting indicated orebodies are Gunnar Gold with an estimated $65-million orebody, and Rix Athabasca which is sinking a shaft to develop two levels. Other areas in Canada are under exploration.

In Africa

MINING ENTHUSIASTS in the Union of South Africa insist that uranium is no longer a by-product of gold production, but rather a "co-product." Calvin McLean, president of the Transvaal Chamber of Mines, remarked early this year that uranium production would raise the yearly value of the output of South African gold mines from £140 to £200-million. Since then the number of mines scheduled to produce slimes for uranium production has increased from 16 to 20. Profits of West Rand Consolidated, first company to start producing uranium concentrates, have been closely watched. During the quarter ended Dec. 31, 1952, the company attributed profits of £124,707 to uranium, and during the first quarter of 1953 this figure was raised to £138,304. Now that Daggafontein has come into production with plant capacity considerably in excess of that of West Rand Consolidated, estimates of uranium revenues are on the optimistic side. For complete details on South African uranium, refer to *E&MJ* May 1953.

In Australia

INITIAL DISCOVERY of uranium in the Rum Jungle area of Northern Territory last year set off a feverish exploration campaign in which geiger counters, bulldozers, diamond drills, and airborne radiation equipment (left) speeded up the search for uranium. As a result at 200-mile belt extending from Darwin to 30 miles south of Katherin has been reported as potential uranium-bearing ground. First shipment of ore was made April 11, 1953, and the area is now reported to be in production. Purchases are made under a 10-year contract signed by the U. K., Australia, and the U. S. A similar agreement was signed to cover Radium Hill production in South Australia. Spurred by these finds Australia is enthused about her atomic future, and news reports are full of references to possible uranium refineries, a £48,000 atomic research laboratory, and an atomic pile for industrial purposes.

Other occurrences of uranium in Australia have been reported at Crocker Wells 40 miles south of Radium Hill, and at Broken Hill.

TITANIUM

TITANIUM TAKES TO THE AIR in historic test flight of Douglas DC-7 commercial airliner, May 18, 1953.

FEVERISH RESEARCH campaigns now under way by government and industry to cut production costs of titanium metal and sponge rule out any short-range outlook for the metal. Price alone will tell how soon consumption will rise from a few thousand tons per year to hundreds of thousands of tons per year. Nevertheless, this huge potential demand is spurring many factors in the industry to develop the "cheapest production method the fastest"—and naturally no one is saying very much about critical metallurgical details.

In the meantime, defense requirements for titanium are lending support to the tens of millions of dollars being spent annually to expand metal production capacity. From a defense standpoint, titanium is a "must" metal. It is said to be more resistant to shock than any other metal known—hence it is ideal for armorplate. Its resistance to salt-water corrosion makes it ideal for naval applications, including submarine snorkel tubes, condensers, heat exchangers, and superstructure members. Lightness, strength, and resistance to heat account for the great demand for use in aircraft. The weight of a jet engine can be cut in half by using titanium thus permitting an increase of thousands of pounds of payload for a single plane. All Air Force engines will eventually use titanium. However, these military requirements for land, sea, and aircraft are but the prelude to huge civilian applications that will ultimately materialize. Witness the world's fastest commercial aircraft, shown above, which contains vital parts of titanium.

Progress in the titanium industry during the past five years has been rapid, even though ultimate goals of lower production costs appear to be obscure and far ahead. Previous to this five-year period, the Military recognized the outstanding qualities of titanium metal for defense equipment. But as long as India remained the major source of raw materials, and ships carrying ilmenite were required to hazard submarine-infested waters in time of war, little was said about titanium's virtues. However, once it was realized that huge reserves of ilmenite existed in eastern North America from Florida to Labrador, the fear of an interrupted supply of raw materials evaporated, and the development of titanium metallurgy was given a "full-steam-ahead" status.

The following schedule of production rates for titanium sponge (and metal) gives you some idea of the meteoric rise of titanium:

Titanium Production in U. S. A.

1946	A few tens of pounds
1946-47	A few hundreds of pounds
1949-50	A few tens of tons
1951	550 tons
1952	1,100 tons
1953*	3,400 tons
1954*	7,000 tons
1956*	18,600 tons
1960-70**	100,000 to 200,000 tons

* Based on various reliable estimates.
** Based on Paley report which assumes that price of titanium sheet may drop from $12 to $15 per lb., to $1 per lb. by 1960-70.

Admittedly these are only rough estimates. Notwithstanding, the entire titanium industry, from the

More About the Plane

This Douglas DC-7 is the fastest piston-powered commercial airliner in the world—faster than existing commercial jet planes.

The new plane will carry 69 to 96 passengers on trans-continental or trans-oceanic schedules.

A major improvement contributing to operating safety is the use of titanium for approximately 90% of the engine nacelles and for engine firewalls. This is the first appreciable use of high-strength, heat-resistant titanium in a commercial airliner

The purchase of 58 DC-7's has been announced.

Still a "precious" metal averaging about $1 per oz. in fabricated form, titanium promises to become a useful economic metal

Titanium Metals Corp. ships 1500-lb. ingots from its Henderson plant.

producer of raw materials to the fabricator of the metal, is forging ahead with amazing speed—and everywhere there is complete faith that research will eventually evolve methods to solve the high-cost production problems that face the industry. Aluminum went through this ordeal and came out on top, and so will the titanium industry. The following lists indicate expansion programs now under way, and the growing number of companies showing interest in the development of the infant titanium industry.

Producers of Sponge and Metal

Titanium Metals Corp. Subsidiary of National Lead Co. and Allegheny Ludlum Steel Corp. Plant at Henderson, Nevada. Expanding production rate is nearing 10 tons of sponge per day. Five-year contract with DMPA calls for production of 18,000 tons over a five-year period. Cost of expansion facilities reported to exceed $15-million.

E. I. du Pont de Nemours and Co. Plant at Newport, Delaware. Expansion program costing about $14.7-million will increase 1952 capacity of 2½ tons per day to about 10 tons of sponge per day by 1954. Contract with DMPA calls for production of 13,500 tons of sponge over a five-year period.

Pending Production Contract

The Crane Co. Negotiations are under way for a $26-million loan and Government purchase contract for the production of 6,000 tons of sponge annually at a plant to be situated near Nashville, Tenn.

Foreign Producer of Sponge

Osaka Titanium Co., Japan. Reported to be marketing five tons of sponge monthly at $9,600 per ton, $400 under the domestic price for sponge.

Titanium Research Programs

Battelle Memorial Institute, Columbus, Ohio
Armour Research Laboratories, Chicago, Ill.
U. S. Bureau of Mines, Henderson, Nev.
Office of Naval Research
Watertown Arsenal, Mass.
Horizons, Inc., Cleveland, Ohio
Kennecott Copper Co. (At Battelle)
New Jersey Zinc Co., Palmerton, Pa.

Producers of Titanium Metal and Mill Products

Titanium Metals Corp., Henderson, Nev.
Rem-Cru Titanium, Inc., Midland, Pa.
Mallory-Sharon Titanium Corp., Niles, Ohio
Republic Steel Corp.
Superior Tube Co., Norristown, Pa.
Trent Tube Co., East Troy, Wis.

Other Companies Interested In The Titanium Field

The Glidden Co., Cleveland, Ohio
Bohn Aluminum and Brass Co., Detroit, Mich.
Titanium Co. of America, Chicago, Ill.
Dow Chemical Co., Midland, Mich.
Union Carbide & Carbon Co., N. Y.
American Cyanamid Co., Stamford, Conn.
Foote Mineral Co., Philadelphia, Pa.

Plenty of Ilmenite

Nowhere in the titanium industry today does one detect any serious concern about the future supply of ilmenite, principally because of the huge reserves discovered in Canada. Reserves in North America, extending from Florida to Labrador, appear to be completely ample to support a fast growing titanium industry even if requirements for ilmenite for metal and pigment production run into millions of tons per year.

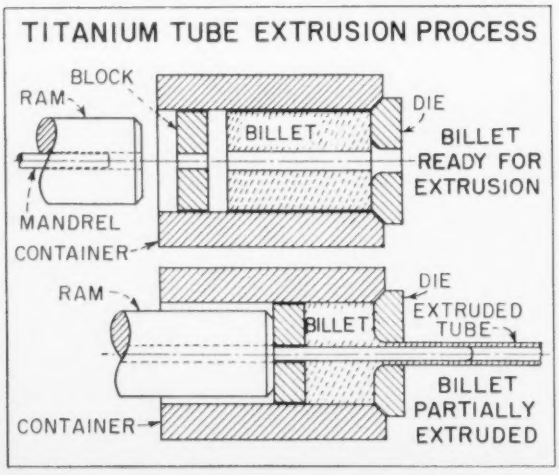
In the U. S., expansion of production leveled off last year (see *E&MJ*, Feb. 1953, p. 94), with National Lead Co. continuing as largest domestic producer at a steady pace. Likewise in Florida, Du Pont's property, using Humphreys spirals, continued producing at a rate of about 100,000 tons of ilmenite annually. National Lead, looking to the future, has acquired 1,000 acres of ilmenite-bearing land near Jacksonville Fla. In Idaho two dredging outfits are adding to the nation's output of ilmenite in the Big Creek area near Cascade.

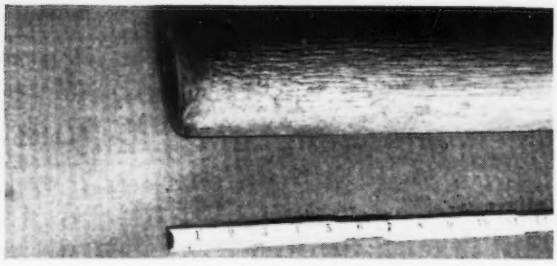
Quebec Iron & Titanium Corp.

Even though output of titanium-rich slag at the Sorel, Quebec,

Plenty of Ilmenite

RESERVES OF ILMENITE in North America will last for more than a century, even if ilmenite consumption for metal and pigments rises to several million tons per year. Shown here are "mountains" of stored ilmenite at Du Pont's Edge Moor plant where titanium dioxide is extracted to make pigments.





A Step Forward in Metallurgy

A TITANIUM TUBE EXTRUSION PROCESS has been carried out successfully at the plant of Chase Brass & Copper Co., subsidiary of Kennecott Copper Corp. Equipment used to extrude titanium is shown above. An extruded titanium tube is shown below the drawing of the extrusion equipment.

smelter increased from 17,259 tons in 1951 to 37,626 tons in 1952, and slag shipments increased from 7,179 tons to 34,739 tons during the same period, the operations are reported as being "on an experimental basis." Nevertheless, this project, owned jointly by Kennecott Copper Corp. and New Jersey Zinc Co., can point to several significant accomplishments:

1. It took much courage and considerable engineering skill to jump from 1500-kw. pilot plant operation to an 18,000-kw. furnace with 300-ton-a-day capacity. This was accomplished successfully at Sorel in 1951.

2. After a trying shake-down period during which equipment and techniques underwent constant improvement, the Sorel plant expanded operations from a 1-furnace capacity to a 5-furnace capacity in a short six-month period ending March 1953.

3. During the same period it was necessary to maintain production of a grade of slag (about 72% TiO_2) that would prove acceptable to the pigment manufacturing industry. It did prove acceptable, as the increase in shipments of slag readily shows.

4. Latest improvements at the Sorel smelter include storage buildings and slag loading equipment which now make it possible to ship slag via the St. Lawrence to ocean ports all over the world. The first shipload of slag departed from Sorel late last year to Atlantic ports U.S.A.

5. Sorel is one of the few metallurgical plants in the world that makes a metal and a slag, both of which are marketable. (The ore runs about 20% Ti and 40% Fe.) Iron produced at Sorel is ideal for steel making and finds a ready market in Canada, and the slag finds a ready market among pigment manufacturers because less sulphuric acid is required to extract the TiO_2 from the slag than from ilmenite. Furthermore, if pigment plants are designed to take advantage of the properties of the slag, a smaller capital expenditure is required to produce a given amount of TiO_2 per year.

6. The slag is now being used experimentally to make tetrachloride for the production of titanium metal. Pilot plants utilizing the fluidized bed, and the briquetted charge techniques have converted titanium contained in the slag to titanium tetrachloride.

Kennecott's interest in titanium goes beyond the production of slag however, and at present the company is sponsoring a 200 to 240-lb. a day pilot plant for the produc-

Research Did It!

Fast growing stack of reports compiled by Du Pont's staff from 1944 to 1951 indicates intensity of research required to boost titanium production . . . . . **from a thimbleful in 1944—** peak test-tube output for Ted McKinley (lower left), first Du Pont chemist to do titanium research . . .

. . . **to a 2,500-lb. chunk of sponge in 1953** (right), produced at Du Pont's Newport plant. Du Pont also pioneered in sponge-melting techniques resulting in the production of the world's first 4,000-lb. ingot.

From a thimbleful in 1944 . . . . . to a 2,500-lb. chunk of sponge in 1953.

tion of metal at the Battelle Memorial Institute. In addition, the company's subsidiary, Chase Brass & Copper Co., has successfully extruded titanium metal in the form of tubing—another forward step in titanium metallurgy (see p. 144).

Horizons Incorporated

In addition to the major metal producers listed in the table on page 143 it should be added that Horizons, Inc., a research organization doing work for private industry and the Navy, has been experimenting with the production of titanium metal by an electrolytic process. The management reports conservatively that work thus far, under the direction of Dr. Eugene Wainer and his associates, has produced "some very interesting results, and we are encouraged." If and when these results warrant larger scale operations, another organization, Horizons Titanium Corp., will be prepared to carry out the actual commercial production of the metal.

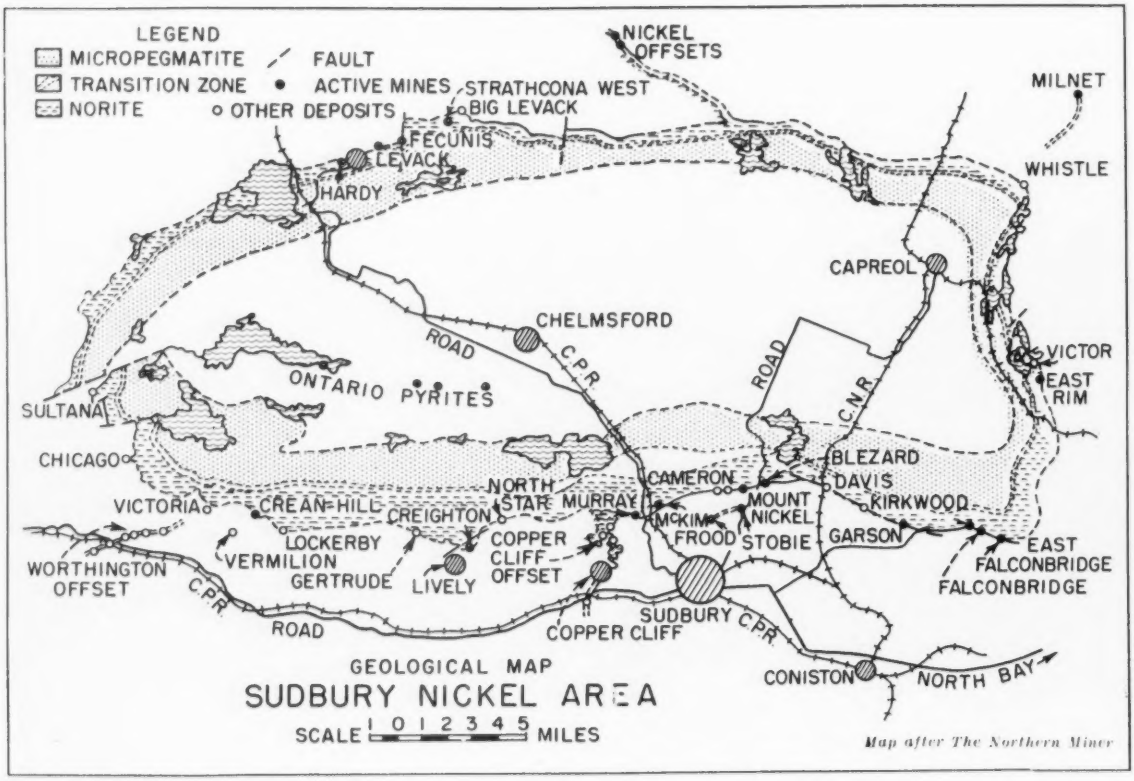
Although the titanium industry in North America has been given greater emphasis in this review, present worldwide interest in titanium should not be overlooked. Metallurgists in Great Britain, France, Japan and elsewhere have also recognized titanium's possibilities—and judging by the metallurgical accomplishments of these nations in the past, the sphere of competition will extend beyond the Western hemisphere. For one thing, the Kroll process was actually conceived in Germany. Likewise, Japan has been doing intensive research and even now is underselling American producers in the titanium sponge market. British metallurgists have exhibited forgings and other products of titanium. India, long the world's major source of ilmenite, still possesses what appear to be inexhaustible reserves of sands which are repeatedly replenished by violent wave action of the ocean in the Travancore area, which exports some 250,000 tons of ilmenite annually. More recently, ilmenite has been discovered along a 25-mile strip of coastline near Ratnagiri. Reserves are sufficient to supply an additional 250,000 tons of ilmenite a year. Britain, Japan, and Czechoslovakia are interested customers.

Where Is Research Heading?

Titanium's future leans heavily upon research—specifically for the production of cheaper metal.

(Continued on page 316)

NICKEL-COBALT



NEARLY $250,000,000 in nickel, copper, cobalt, and precious metals has come from this phenomenal district in Canada.

The Sudbury Basin

FEW MINERAL DISTRICTS in the world come even close to the enormously productive Sudbury Basin, where International Nickel Co., and Falconbridge Nickel Mines, Ltd., have for years supplied the major part of the world's demands for nickel.

However, the need for nickel has grown so rapidly in recent years that even Sudbury can't keep up with it. In the resulting expansion effort, new producers have entered the Basin, and old mines are reopening.

Here are the producers shown on the map above:

International Nickel Co., has these mines: Creighton, Garson, Murray, Frood-Stobie, Levack, and Crean Hill. Inco's stepped-up production from its underground mines, announced last year, was further increased last month by a contract with DMPA to produce an additional 120 million lb. of nickel and 100 million lb. of copper from low-grade areas in the Stobie and Murray mines. Inco says that mining the extra 10 million tons of underground ores will take about 10 years and require large capital outlays.

Actually, Inco has reached the top of the world's non-ferrous metal underground operations with a hoisting capacity of about 13,000,000 tons yearly.

Falconbridge, Canada's second largest producer, has mines at Falconbridge, East Falconbridge, and McKim. The DMPA in March announced a contract with Falconbridge that will bring 50,000 tons of nickel to the U. S. by mid-1962. This will come from new orebodies that Falconbridge will open with an investment of well over $42-million. No loan was involved, but the U. S. will pay the market price of the nickel, plus an allowance for amortization that is believed to bring the price to around $1.00 per lb.

Falconbridge is developing mines at Hardy, Fecunis Lake, and Mount Nickel. It is surface-drilling at Blezard and Strathcona West.

Among the independents, Nickel Offsets is building a 200-ton mill to be completed late this year.

Milnet Mines is also working the offsets and shipping the resulting ore to Falconbridge.

East Rim Nickel Mines, Ltd., is working an orebody estimated to contain over 2 million tons of ore. It has a DMPA contract for not less than 3,500 tons of ore per month, which will be processed by Falconbridge.

With all these agreements, and others, the U. S. is believed to have almost enough nickel in sight to meet its requirements. Purchase contracts now in effect involve 520 million lb. of nickel over the next decade.

A REVOLUTION is forecast for Rhodesian cobalt. This electrolytic plant of Rhokana, brand new, is its forerunner.

Rhodesian Cobalt

COBALT OCCURS in the ore of Rhokana Corporation, Ltd., one of the four big copper producers of the Northern Rhodesian Copperbelt, to the extent of about 0.15%. In 1952, Rhokana produced cobalt to the value of about £1,000,000. This was only about 1.3% of the total value of Northern Rhodesia's mineral output, but cobalt output here will bear watching. Something approaching a revolution is coming.

For many years, cobalt was produced as a by-product. It ended up as a high grade alloy with iron and copper, which Rhokana sent overseas to be refined. Selective flotation of Rhokana ores produced a cobalt concentrate carrying 3.5% cobalt, 25% copper, and 17% iron. This was smelted in a separate reverb to recover the copper, then the cobalt was picked up in the converter slag and finally granulated and reduced with coke in electric arc furnaces. The process was not efficient.

Following years of research, a new plant for electrolytic production of cobalt was commissioned in 1952. It is now in successful commercial operation, and the old alloy process will eventually be replaced altogether.

At present the old and the new plants are operating at a combined rate of about 2,000,000 lb. of cobalt annually. When the new electrolytic plant has reached its scheduled rate, a much larger output is expected.

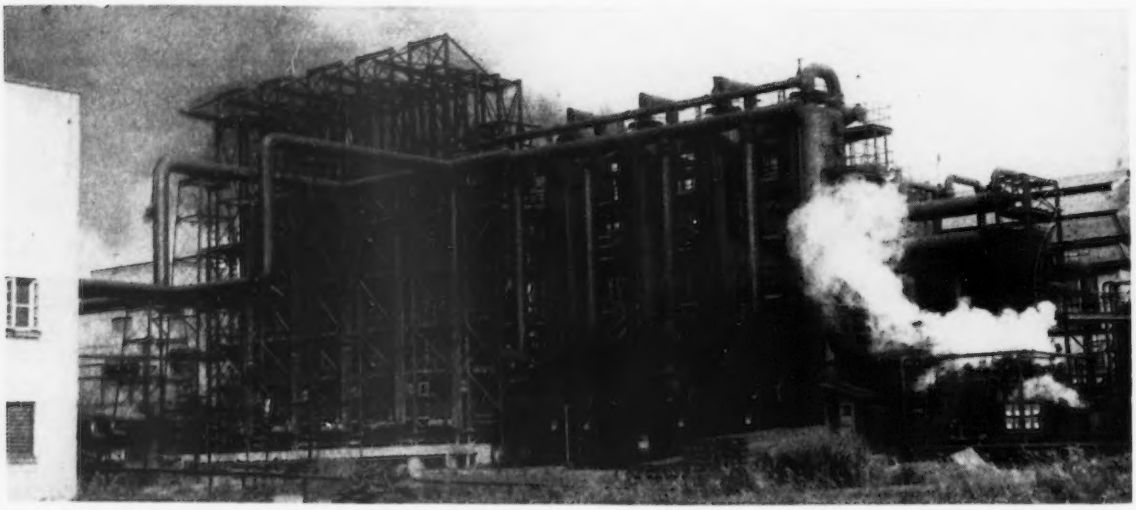
Research is now centered on improving the flotation process for recovering the cobalt. A major development in this step is now awaiting pilot plant tests.

In addition, there are vast tonnages of Rhokana slag that could be re-treated, now that improved metallurgical techniques are available. The Chibuluma enterprise (see p. 118) will contribute about 500,000 lb. of cobalt annually from its 0.25% ore.

The new Rhokana cobalt plant, pictured above, employs a sulphatizing roast, followed by leaching with hot water. The solutions are purified by aeration and by addition of milk of lime. Any trace of copper is removed by circulation over cobalt granules.

Cobalt is then completely precipitated by agitation with milk of lime, and the resulting cake is dissolved in spent electrolyte. In the cells, mild steel cathodes and antimonial lead anodes are used. Cathode current density is 15 amp. per sq. ft. Current efficiency runs over 80%. Cobalt content of the electrolyte is about 35 grams per liter.

This information has been contributed by Messrs. Talbot and Chapman of Anglo-American Corporation. Further details will appear in an early issue.



HEATED DEBATE surrounds Nicaro nickel in Cuba, but plant produces over 2 million lb. monthly, is going higher.

The Cuban Nickel Ores

NICKEL PROCESSING CORP., the management company that operates the Nicaro nickel project in Cuba for the U. S. government, reports monthly production of combined oxides running up to 2.4-million lb. of nickel and 22,000 lb. of cobalt. Recovery of nickel for the three months ending March, 1953, averaged 78.1%, about 8% higher than the average for the last ten months of operations in 1946.

Nickel Processing Corp. is owned jointly by Cuban and American capital, 60% of it being held by National Lead Co. Projected goal of the Cuban plant is a production of 30-million lb. a year. Restoration of the wartime plant has cost about $12-million. The subject of much controversy over the government's disposition of the plant, Nicaro is nevertheless steadily improving in output and metallurgical results. A new process is under test by National Lead, and recovery of pure metals instead of the oxides is a possibility.

Nicaro's troubles with leaching of ore containing serpentine will be absent in treating a nickel orebody announced recently by Freeport Sulphur, located at Moa Bay, 40 miles east of Nicaro. The deposit carries 1.35% nickel and 0.14% cobalt in about 40-million tons of ore. Nicaro's ore runs about 1.4% nickel.

Freeport, the company that operated Nicaro for the government during the war, is planning to build a plant at Moa Bay to produce about 30-million lb. of nickel and 3-million lb. of cobalt annually. Freeport enters this project strictly as a commercial venture, feeling that the character of the ore and the new techniques available to process it make the project feasible in a competitive market.

Moa Bay ore will be leached with sulphuric acid (not possible with Nicaro's ore owing to formation of magnesia from the serpentine). A variation of the Chemical Construction Co.'s precipitation technique will be used to produce pure metals.

NEW DISCOVERY of nickel ore in Cuba could put Freeport Sulphur in second place in world's production list.

Sherritt Gordon—A New Technique

AMONG THE MOST INTERESTING, and most promising metallurgically, of the new ideas in nickel production is the Lynn Lake project of Sherritt-Gordon Mines, Ltd. The orebody is located in northern Manitoba; the concentrate produced at the mine will be treated at a refinery now being built at Fort Saskatchewan, Alberta, where low-cost natural gas is readily available. (For a description of the mine and process, see *E&MJ*, Nov. 1951, "Sherritt Gordon Develops Lynn Lake Nickel-Copper.")

Lynn Lake ore averages 1.223% nickel, 0.618% copper, and enough cobalt to make its recovery worthwhile. Flotation will produce a concentrate carrying 28% copper, and a nickel concentrate containing 11 to 14% nickel. The copper concentrate will be treated by conventional methods, at the Noranda Mines' smelter in Quebec. The nickel concentrate, which will actually carry 10 to 14% nickel, 1 to 2% copper, and some cobalt, will be treated by a high-pressure ammonia leach at the Alberta refinery.

Pilot plant work on the new process was begun early in 1949. There have been four pilot plants set up and operated at research headquarters in Ottawa, the latest of which began operations in March, 1953. The process has by now been thoroughly tested and successful full-scale production seems assured. For a full description of the pilot plant work, see a paper presented to the Canadian Institute in April, 1953, by Professor Frank A. Forward, of the University of British Columbia. Professor Forward was the discoverer of the ammonia leach technique eventually adopted for the Lynn Lake ores.

The Lynn Lake nickel concentrate will be leached with ammonia at temperatures of the order of 150 to 220 deg. F. under total pressures of less than 125 psi. After a washing step, the pregnant solution is boiled at atmospheric pressure to precipitate copper sulphide.

Hydrolysis and oxidation of solutions follows, then hydrogen reduction of nickel is carried out. Temperatures range between 200 and 400 deg. F., and pressures run as high as 900 psi for these steps. Cobalt is also precipitated by hydrogen. The stripped solution contains only ammonium sulphate, which is recovered as a by-product for sale to the fertilizer industry.

NICKEL-COBALT REFINERY of Sherritt Gordon, using new process, is going up here near Edmonton, Alberta.

To reduce maintenance and prevent corrosion, all wetted surfaces of autoclaves, agitators, pipelines, pumps, valves, and tanks are made of stainless steel. Little difficulty has been met with corrosion, scaling, erosion, or precipitation of insoluble salts.

The refinery is planned for operation in January 1954. Total cost of the venture will be about $40.5-million. When in full-scale operation, the plant is scheduled to produce about 8,500 tons of nickel, 4,000 tons of copper, and 150 tons of cobalt yearly.

Nickel In The West

THE SHERRITT GORDON process and plant may also help produce nickel from a mine in British Columbia now under development by Western Nickel, a wholly-owned subsidiary of Pacific Nickel Mines, Ltd., of Vancouver, and Newmont Mining Corp., of New York. An eventual estimated expenditure of about $4.75-million will be required if the mine is brought into production. Concentrate would be treated in the Sherritt Gordon refinery.

Production at an annual rate of up to 8 million lb. of nickel would be delivered to the U. S. government for a seven-year period. The government is aiding in financing the project through loans for development and eventual production.

In Oregon, the M. A. Hanna Co., of Cleveland, through its subsidiaries, Hanna Coal & Ore Corp. and Hanna Nickel Smelting Co., are aiming at production of 95 to 125 million lb. of nickel annually from an orebody near Riddle, Ore. Hanna will use an electric smelting process developed in France.

Hanna will develop the mine at its own expense (about $4.3-million). The DMPA will advance the company up to $24.8-million for construction of a smelter. The plant will produce ingots of ferro-nickel, which can be substituted for pure nickel in making stainless or low-alloy steels. Price of the ore will be $6.00 per dry ton for 1.5% ore, the average grade. Hanna Nickel will pay Hanna Coal & Ore the same price for the ore, and will receive from the government not to exceed 79.39c. per lb. of nickel for smelting it, plus amortization of the plant.

SMALL MINES

Low in unit output, but unmatched in faith and courage, the industry's small enterprises collectively play an indispensable role in building a sound future for mining

In this 12-page section you will find:

- **A report on one Government activity that has helped small mines.**
- **A round-table discussion of the small miner's problems.**
- **Suggestions for their alleviation.**

How the DMEA Is Aiding Exploration

THE MINERAL EXPLORATION PROGRAM of the Defense Minerals Exploration Administration, now two years old, is just reaching it productive stage. It is proving its benefit to the taxpayer with the passing of each additional month.

Two years ago, on May 16, 1951, Contract No. 1 was executed between the Government and an operator. It involved a diamond drilling program to prove extensions of lead and zinc orebodies. It is one of the group comprising 55% of all contracts executed by DMEA to date which entail project costs of less than $25,000.

Work under the contract began May 23, 1951, and continued uninterruptedly until 100% complete in January 1952. On the basis of the operator's final report, a certification of discovery or development was issued by DMEA in July 1952.

In the past 12 months the number of active contracts has increased from 252 to 329. New approvals nearly offset contract terminations, and the program is now characterized by vitality and soundness.

By May 31, 1953, DMEA had executed 498 exploration contracts, and 14 others were approved and awaiting signatures of the operators. The 512 project approvals have resulted from 1,865 applications received during the entire period. Of this total, 781 applications were rejected and 327 applications were withdrawn by the operators.

As of May 31, 1953, DMEA had 259 cases pending, of which 93 were in the final stages of processing in Washington and 135 had undergone preliminary review.

The 498 contracts executed involve the search for more than 26 critical and strategic minerals in 31 states and Alaska, and have an aggregate approved project cost of $24,396,489, of which the Government has agreed to contribute $14,696,933. Only $6,746,136 of Government funds has been spent, however, in these two years of operation, and the greater part of the sum disbursed has been on projects which are still active and will not be brought to completion for months. Of the 498 exploration contracts executed, 127 were completed and terminated as of June 1, 1953. A total of $868,172 of Government funds has been spent on these projects. Forty-eight certifications of discovery or development have been issued, officially recording success in the finding of a dozen strategic and critical minerals.

It is noteworthy that records covering the 127 terminated projects indicate that 86% of the Government funds allocated for work on successful projects was actually disbursed, whereas only 44% of the funds allocated to unsuccessful projects was spent. This interesting observation reflects the vigilance and cooperation of the DMEA field teams and the operators in closely appraising the results of the work and agreeing to halt exploration expense as quickly as it is recognized that further operations are not justified.

Ore has already been found on 120 projects, and 5[illegible] of these have entered production. Forty-eight operators have begun royalty payments to the Government in repayment of advances totaling $60,172 and representing a gross net smelter value for ore already marketed of $1,203,440.

In accordance with the basic objectives of the exploration program, the amount repaid to the Government for its contribution to the cost of the projects must be considered largely incidental, and not a measure of its success. Some deposits not presently amenable to production for economic reasons may become of primary significance during periods of extreme emergency.

DMEA's experience thus far reveals that 73% of all contracts executed to date entail project costs of less than $50,000 each, and that the aggregate participation in these contracts accounts for about 42% of the total Government funds approved under the program. **This situation tends to reflect the fact that the majority of domestic deposits of minerals historically in short supply are not readily distinguishable in magnitudes which justify large-scale exploration and development programs. Certainly, the program is particularly beneficial to the small operator.**

Exploration operations for many of the critical metals and minerals require special experience and technology which are not widely available, even in the case of the larger mining concerns. It is here that the technical personnel of the U. S. Geological Survey and the Bureau of Mines, who supervise work in the field, contribute valuable service to the small operator by guiding his project work intelligently.

Guideposts For The DMEA

THE FUNCTION of the Defense Minerals Exploration Administration is to provide Government aid in finding new sources of strategic and critical minerals in the U. S.

The DMEA operates within the Department of the Interior. C. O. Mittendorf is administrator. The principles by which the agency's function is carried out are as follows:

1. Exploration work will be done by the applicant who controls the prospect, not by Government.

2. Applications for aid will be examined by Government engineers and geologists to determine if they offer a reasonable prospect for discovery.

3. On approving a project, the Government will conclude a contract with the operator that will provide: (1) description of work to be done; (2) a contribution by Government to the cost of the work; (3) repayment of Government's contribution by percentage royalty on any resulting production; (4) a contractual, unrecorded lien on the operator's interest in the real property to secure the royalty.

4. Compliance with the terms of the contract will be checked by the Government periodically.

5. Government will audit the claims for contributions to determine that contract terms allow them.

6. The Government will evaluate the work's results. If it appears that a discovery or development has been made that may yield production within 10 years from date of contract, the Government may so certify to the operator.

DMEA Contract Projects Thru April, 1953

Name	Commodity	Gov't Part	Total Value
ALABAMA			
Schroeder Co.	Iron	$112,500.00	$225,000.00
Bourne Associates	Mica	16,200.00	18,000.00
ARIZONA			
S. B. Owens	Zinc, Copper	31,963.00	63,926.00
American Asbestos Cement Corp.	Asbestos	111,482.10	123,869.00
Bear Canyon Mining Co.	Asbestos	23,598.00	26,220.00
D. W. Jaquays & Co.	Asbestos	10,800.00	12,000.00
Metate Asbestos Corp.	Asbestos	2,745.00	3,050.00
H. R. Scott & W. A. Scott, R. D. Vinck	Asbestos	12,722.10	14,136.00
W. W. Sorsen and W. C. Williams	Asbestos	19,575.00	21,750.00
Ord Mercury Mines	Mercury	21,000.00	28,000.00
Globe Miami Copper Zinc Corp.	Zinc	31,875.00	63,750.00
Fluorspar Producers Corp.	Fluorspar	6,925.00	13,850.00
Ace Building & Roofing Supplies	Manganese	17,880.00	23,840.00
Yucca Mining & Milling Co.	Copper	29,735.00	59,470.00
Arizona Metals Co.	Lead Zinc	23,050.00	46,100.00
Reed & Reed	Lead Zinc	10,000.00	20,000.00
Arizona Copper Mines, Inc.	Copper	25,000.00	50,000.00
Banner Mining Co.	Copper	67,894.50	135,789.00
Banner Mining Co.	Copper	63,393.00	126,789.00
Magma King Manganese Mining Co.	Lead Zinc	11,550.00	23,100.00
Nikas Mining Co.	Tungsten	44,400.00	59,200.00
J. P. Nash	Lead Zinc Copper	17,000.00	34,000.00
I. W. Kusisto	Lead Zinc	2,500.00	5,000.00
Yuma Metals, Inc.	Lead Zinc	47,500.00	75,000.00
ARKANSAS			
Westmoreland Manganese Corp.	Manganese	12,000.00	16,000.00
Westmoreland Manganese Corp.	Manganese	15,000.00	20,000.00
Arkansas Manganese Co., Inc.	Manganese	15,000.00	20,000.00
Inland Mining Corp.	Manganese	75,000.00	100,000.00
A. J. Gold & J. Gold	Antimony	12,684.75	16,913.00
CALIFORNIA			
R. E. Fitzgerald, Trustee	Zinc-Copper	10,310.00	20,620.00
Sierra Copper Co.	Copper	8,306.50	16,613.00
G. McGuire Pierce	Tungsten	11,250.00	15,000.00
Holmestake Mining Co.	Tungsten	14,250.00	19,000.00
F. Dumontier and S. Skartvedt	Asbestos	5,334.52	5,927.36

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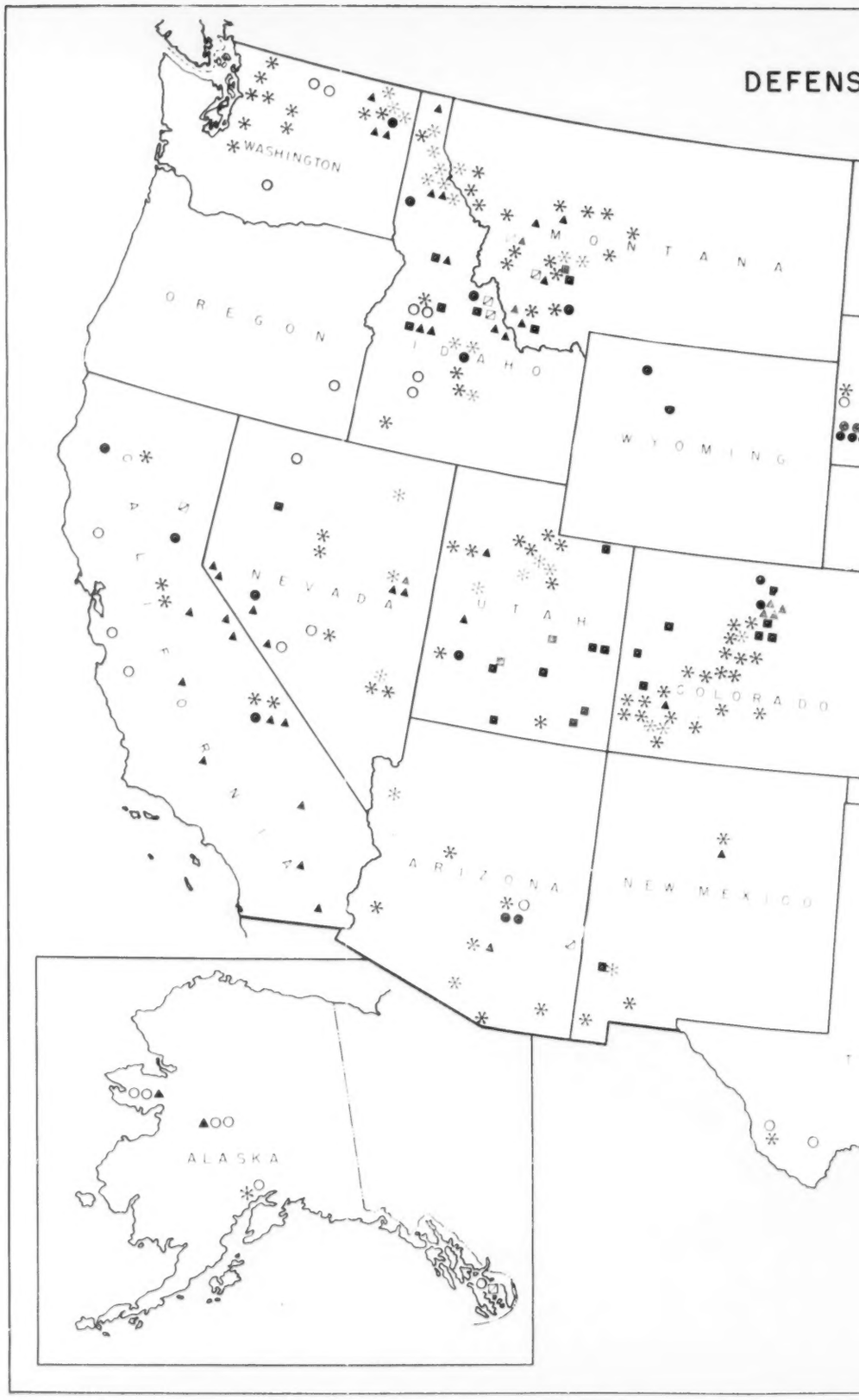
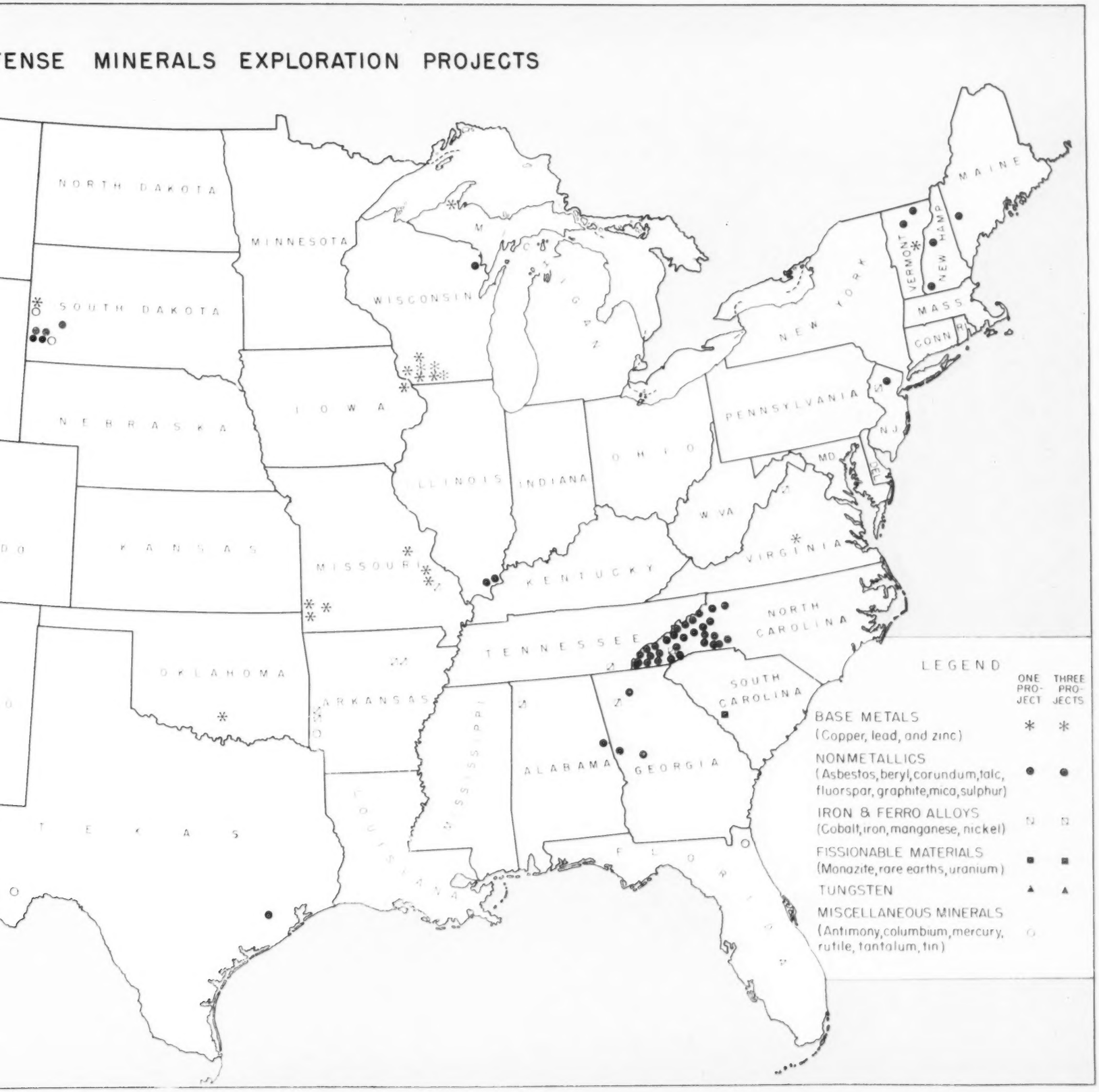


TENSE MINERALS EXPLORATION PROJECTS



DMEA CONTRACT PROJECTS THROUGH APRIL 30, 1953

Name	Commodity	Gov't Part.	Total Value
CALIFORNIA (Continued)			
H. E. Briggs	Lead-Zinc	8,650.00	17,300.00
L. D. Foreman	Lead-Zinc	6,120.00	12,240.00
Miller & Warnken	Tungsten	45,000.00	60,000.00
Northfield Mines, Inc.	Tungsten	33,540.00	44,720.00
Petroleum Investment Trust Ltd.	Tungsten	10,527.00	14,036.00
California Quicksilver Mines, Inc.	Mercury	29,580.00	39,440.00
Black Rock Mining Corp.	Tungsten	46,217.63	61,623.50
Black Rock Mining Corp.	Tungsten	86,250.00	115,000.00
The Philip Carey Mfg. Co.	Asbestos	71,550.00	79,500.00
Lakeview Manganese Mines	Manganese	9,750.00	13,000.00
Sweeney Tungsten Co. Ltd.	Tungsten	22,350.00	29,800.00
New Idria Mining & Chemical Co.	Mercury	182,511.75	243,349.00
Hidden Hills Co.	Tungsten	12,600.00	16,800.00
Surcease Mining Co.	Tungsten	25,050.00	33,400.00
Tungsten Prospecting Associates	Tungsten	5,025.00	6,700.00
Cordero Mining Co.	Cinnabar	150,621.00	200,828.00
The Ghidden Co.	Zinc-Copper	147,150.00	294,300.00
The Philip Carey Mfg. Co.	Asbestos	71,550.00	79,500.00
T. A. Hazelton	Tungsten	4,470.00	5,960.00
COLORADO			
Empire Mining & Engineering Co.	Fluorspar	2,712.50	5,425.00
Boulder Tungsten Mines, Inc.	Tungsten	40,026.75	53,369.00
Blue Jay Mines	Tungsten	7,875.00	10,500.00
Cold Spring Tungsten, Inc.	Tungsten	158,310.00	211,080.00
G. Coughlin & E. L. Henderson	Tungsten	3,600.00	4,800.00
Eureka Tungsten	Tungsten	15,000.00	20,000.00
G. Jump	Tungsten	9,000.00	12,000.00
S. Larson & R. Plummer	Tungsten	18,750.00	25,000.00
J. & A. McBroon	Tungsten	9,450.00	12,600.00
J. Smith & C. Rugg	Tungsten	18,300.00	24,400.00
T. C. Stanford	Tungsten	16,687.50	22,250.00
Tungsten Mining Co., Inc.	Tungsten	7,500.00	10,000.00
Vasco Tungsten Corp.	Tungsten	13,125.00	17,500.00
Utze Lode Co.	Lead-Zinc	10,000.00	20,000.00
Utze Lode Co.	Lead-Zinc	24,750.00	49,500.00
Lupton Mining Co.	Lead-Zinc	41,180.50	82,361.00
Montana Mining Development Co.	Lead-Zinc	7,500.00	15,000.00
J. A. & B. A. Smith	Lead-Zinc	12,500.00	25,000.00
Gold Bar Mines, Inc.	Uranium	6,984.00	7,760.00
Defender Mining Co.	Lead-Zinc	2,399.80	4,799.60
Erickson & Baer	Lead & Zinc Ores	1,600.00	3,200.00
M. L., L. M., P. R. Jones, and E. M. Lill	Lead-Zinc	4,130.00	8,260.00
W. L. Weaver	Uranium	1,800.00	2,000.00
United Mining & Leasing Corp.	Lead & Zinc	17,101.04	34,202.08
The Realty Co.	Uranium	72,000.00	80,000.00
Callahan Zinc-Lead Co.	Lead-Zinc	85,994.04	171,988.08
Callahan Zinc-Lead Co.	Lead & Zinc	15,305.00	30,610.00
Moreno-Cripple Creek Corp.	Uranium	56,475.00	62,750.00
Cadwell Mining Co.	Zinc Ore	44,961.00	89,922.00
L. M. Loveless	Copper	1,500.00	3,000.00
J. C. Wild & W. Frandson	Beryl	2,250.00	2,500.00
Cherokee Mines	Uranium	21,600.00	24,000.00
Gateway Mining & Development Co.	Uranium	46,772.10	51,969.00
Outlet Mining Co.	Lead	5,618.75	11,237.50
Uranium Development Corp.	Uranium	19,570.00	21,744.45
Bachelor Development Co.	Zinc-Lead Ores	36,251.50	72,503.00
Robitsch, A. & Brewster, W.	Tungsten	7,237.50	9,650.00
Leadville Lead Corp.	Lead-Zinc	51,300.00	102,600.00
Shelby-Johnson Mines, Inc.	Lead-Zinc	4,900.00	9,800.00
Burleson, S. E. & W. E.	Lead-Zinc	13,300.00	26,600.00
Lead Carbonate Mines, Inc.	Lead-Zinc	17,500.00	35,000.00
Silver Bay Mines, Inc.	Lead-Zinc	10,750.00	21,500.00
Treasure Mountain Gold Mining Co.	Lead-Zinc	37,600.00	75,200.00
U. S. Metals Corp.	Lead-Zinc	19,300.00	38,600.00
Kolego, H. E.	Lead-Zinc-Copper	7,300.00	14,600.00
The Moreno Cripple Creek Corp.	Lead-Zinc-Copper	38,000.00	76,000.00
U. S. Metals Corp.	Lead-Zinc-Copper	56,819.17	113,638.34
Silver Bell Mines Co.	Lead-Zinc	39,560.00	79,120.00
East Ridge Co.	Zinc-Lead-Copper	30,090.00	60,180.00
Moenke, W. F.	Lead-Zinc	1,500.00	3,000.00
Vinson, M. & Harris, F.	Lead-Zinc	18,800.00	37,600.00
FLORIDA			
National Lead Co.	Rutile	15,675.00	20,900.00
GEORGIA			
Jones, A. L., & C. Stancil	Beryl	7,200.00	8,000.00
Foley Mines	Beryl	2,353.00	2,614.00
The Georgia Minerals Corp.	Manganese	21,871.50	29,162.00
Anderson, A. T.	Mica	4,959.00	5,510.00

Name	Commodity	Gov't Part.	Total Value
IDAHO			
Paymaster, Inc.	Lead-Zinc	$47,510.08	$95,020.16
Silver Star-Queen Mines, Inc.	Lead-Zinc	68,443.50	136,887.00
Sun Valley Lead-Silver Mines, Inc.	Lead-Zinc	14,192.00	28,384.00
United Minerals Reserve Corp.	Lead-Zinc	52,000.00	104,000.00
Snoose Mining Co.	Zinc	67,500.00	135,000.00
C. I. White	Copper	28,655.00	57,310.00
Whitedelph Mining & Development Co.	Lead	81,975.00	163,950.00
Funnell & Majer Mining Co.	Lead-Zinc	26,614.00	53,228.00
Hope Silver Lead Mines, Inc.	Lead-Zinc	18,000.00	36,000.00
Chief Joseph Mines, Inc.	Tungsten	5,580.00	7,440.00
J. P. Holtermans	Fluorspar	3,896.50	7,793.00
L. Buchman, L. S. Breckon, J. A. Norden	Lead-Silver	29,495.00	58,990.00
J. W. Bleazard, G. S. Bleazard, E. and F. Shirts	Lead-Zinc	4,200.00	8,400.00
Buckskin Mines, Inc.	Lead-Zinc	6,100.00	12,200.00
Champion Mine	Lead-Zinc	15,825.00	31,650.00
Hoodoo Mines	Lead-Zinc	7,000.00	14,000.00
E. Enderlin & H. Connolly	Zinc	13,560.00	27,120.00
Hermada Mining Co.	Antimony	33,075.00	44,100.00
O. V. Svensson	Antimony	1,833.75	2,445.00
Ruby Meadows Mining Co.	Monazite and Cinnabar	12,647.00	14,052.00
Mullin Mines Co., Inc.	Tungsten	9,300.00	12,400.00
Idaho Beryllium & Mica Corp.	Mica	25,830.00	28,700.00
Northfield Mines, Inc.	Cobalt-Copper	72,030.00	102,900.00
Montana Coal & Iron Co.	Cobalt-Copper	23,345.00	33,350.00
J. R. Simplot Co.	Fluorspar	28,950.00	57,900.00
Defense Metals, Inc.	Thorium and Uranium	61,438.50	68,265.00
Bradley Mining Co.	Tungsten	91,800.00	122,400.00
Bradley Mining Co.	Tungsten	84,000.00	112,000.00
South Mountain Mining Co.	Lead-Zinc-Copper	24,430.00	48,860.00
Bunker Chance Mining Co.	Lead-Copper	76,265.00	152,530.00
Day Mines, Inc.	Lead-Zinc	121,430.00	242,860.00
Golconda Lead Mines	Lead-Zinc	45,000.00	90,000.00
Highland-Surprise Consolidated Mining Co.	Lead-Zinc	100,000.00	200,000.00
Hypotheek Mining & Milling Co.	Lead-Zinc	35,205.00	70,410.00
Nabob Silver-Lead Co.	Lead-Zinc	71,725.00	143,450.00
North Fork Mining Co.	Lead-Zinc	22,250.00	44,500.00
Rhode Island Mining Co.	Lead-Zinc	11,950.00	23,900.00
Sidney Mining Co.	Lead-Zinc	100,145.00	200,290.00
Signal Mining Co.	Lead-Zinc	10,500.00	21,000.00
Spokane-Idaho Mining Co.	Lead-Zinc	71,317.00	142,634.00
Sunset Minerals, Inc.	Lead-Zinc	43,456.50	86,913.00
Bunker Hill & Sullivan Mining & Concentrating Co.	Lead-Zinc-Copper	549,375.00	1,098,750.00
Day Mines, Inc.	Lead-Zinc-Copper	174,320.00	348,640.00
Idaho Mining Co.	Lead-Zinc-Copper	61,869.00	123,738.00
J. Etherton & W. Schmittroth	Tungsten	18,000.00	24,000.00
R. D. Skeman & H. S. Carter	Tungsten	9,900.00	13,200.00
Bradley Mining Co.	Antimony	131,526.00	175,368.00
Bradley Mining Co.	Antimony	39,750.00	53,000.00
L. S. Heller	Lead-Zinc	300.00	600.00
Cosumnes Gold Dredging Co.	Monazite-Columbium-Tantalum	18,003.60	20,004.00
Cosumnes Gold Dredging Co.	Monazite-Columbium-Tantalum	25,942.50	28,825.00
McRae Tungsten Corp.	Tungsten	15,263.25	20,351.00
McRae Tungsten Corp.	Tungsten	40,350.00	53,800.00
ILLINOIS			
Ozark-Mahoning Co.	Fluorspar	30,982.50	61,965.00
Ozark-Mahoning Co.	Fluorspar	24,300.00	48,600.00
IOWA			
J. E. & Lula M. Miller	Lead-Zinc	14,850.00	29,700.00
MAINE			
Beryllium Development, Inc.	Beryl	40,140.00	44,600.00
MICHIGAN			
Calumet & Hecla Consolidated Copper Co.	Copper	284,096.50	568,193.00
MISSOURI			
American Zinc, Lead & Smelting Co.	Lead-Zinc	32,500.00	65,000.00
Shelton Mining Co.	Zinc	7,000.00	14,000.00
Bootman & Boswell Mining Co.	Lead-Zinc	4,934.40	9,868.80
National Lead Co.	Cobalt, Nickel, Lead, Copper	274,078.27	391,540.39
Dale Mining Co.	Lead-Zinc	7,776.00	15,552.00

Name	Commodity	Gov't Part.	Total Value
MISSOURI (Continued)			
A. A. Peugnet	Lead	2,100.00	4,200.00
A. A. Peugnet	Lead-Zinc	1,800.00	3,600.00
MONTANA			
R. Wegener	Lead-Copper	8,750.00	17,500.00
Elkhorn Mining Co.	Thorium	9,193.50	10,215.00
American Alloys Metals Inc.	Tungsten	16,495.35	21,993.80
American Alloys Metals Inc.	Tungsten	24,967.50	33,290.00
American Alloys Metals Inc.	Tungsten	50,185.50	66,914.00
Minerals Engineering Co.	Tungsten	90,960.00	121,280.00
A. and J. Dance	Lead-Zinc	8,970.00	17,940.00
E. E. Pohl, et al	Lead-Zinc-Copper	6,295.00	12,590.00
E. E. Pohl, et al	Lead-Zinc-Copper	6,000.00	12,000.00
Bennett Mining Co.	Lead-Zinc	50,000.00	100,000.00
L. B. Stark	Lead-Zinc	25,000.00	50,000.00
J. Young and A. McDonald	Lead	1,500.00	3,000.00
Western Montana Exploration & Development Co.	Lead-Zinc	42,925.00	85,850.00
H. G. Nicely and J. Schneider	Manganese	2,211.00	2,948.00
Taylor-Knapp Co.	Manganese	80,370.00	107,160.00
Taylor-Knapp Co.	Manganese	37,201.50	49,602.01
Alps Mining & Milling Co.	Tungsten	26,146.50	34,862.00
Combination Development Co.	Tungsten	52,500.00	70,000.00
Double Eagle Tungsten Co.	Tungsten	12,286.50	16,382.00
W. Mulcahy	Lead	2,546.15	5,092.30
A. F. Carlson	Lead-Zinc	12,450.00	24,900.00
A. K. Romerio	Lead-Zinc	10,600.00	21,200.00
White Fine Lead Co.	Lead-Zinc	14,350.00	28,700.00
Elkhorn Consolidated, Inc.	Lead-Zinc-Copper	12,900.00	25,800.00
Elkhorn Mining Co.	Uranium	23,125.50	25,695.00
Elkhorn Mining Co.	Uranium	11,520.00	12,800.00
D. A. McNabb	Uranium	20,616.30	22,907.00
D. Nieminen, A. H. Eiselein and M. Nelligan	Uranium	13,599.00	15,110.00
Hughesville Silver & Lead Mining Co., Inc.	Lead, Manganese, Tungsten	5,000.00	10,000.00
Columbia Mining Co., Inc.	Copper	12,158.90	24,317.80
Ottawa Tungsten Co.	Tungsten	35,700.00	47,600.00
Madisonian Mining & Milling Co.	Asbestos	21,960.00	24,400.00
Commonwealth Leading Mining Co.	Lead	25,290.00	50,580.00
Castle Lead & Zinc Co.	Lead-Zinc	49,925.00	99,850.00
Amador Mining Co.	Copper	36,095.00	72,190.00
Pittsburg Silver Mining Co.	Lead, Copper, Antimony	5,585.00	11,170.00
Linton Mines	Lead	26,270.00	52,540.00
Western Mines Co.	Tungsten	16,200.00	21,600.00
E. Allen and J. M. Allen	Copper	5,400.00	10,800.00
J. E. Hall	Copper	10,642.50	21,285.00
Kootenay Copper Mines, Inc.	Copper	15,950.00	31,900.00
Ambassador Mines Corp.	Lead-Zinc	11,524.50	23,049.00
I. G. Irving and R. H. Nelson	Manganese	5,250.00	7,000.00
Standard Ore & Alloys Corp.	Tungsten	7,560.00	10,080.00
NEVADA			
Lovestedt, A. J.	Tungsten	2,141.25	2,855.00
Wood, D. G.	Tungsten	4,650.00	6,200.00
The Marshall Mining Co.	Copper	25,210.68	50,421.37
United Minerals Reserve Corp.	Lead-Zinc	26,750.00	53,500.00
Bullock, F.	Lead-Zinc-Copper	10,350.00	20,700.00
Dunnigan, W. F.	Mercury	6,693.75	8,925.00
Sykes, I.	Tungsten	7,950.00	10,600.00
Minney, A.	Mercury	13,200.00	17,600.00
Keever, F. B.	Lead-Zinc	10,114.00	20,228.00
Snyder, G. W.	Lead-Zinc	13,897.00	27,794.00
Pennsylvania Mine	Copper	12,896.11	25,792.22
Bristol Silver Mines Co.	Lead-Zinc	90,814.00	181,628.00
Comet Mines, Inc.	Lead-Zinc	95,000.00	190,000.00
Ely Valley Mines, Inc.	Lead-Zinc	43,100.00	86,200.00
Raymond-Combined Mines Co.	Lead-Zinc	54,233.00	108,466.00
Coranda Corp.	Corundum-Andalusite	32,400.00	36,000.00
Rysh & Corwin	Tungsten	9,000.00	12,000.00
Perry, E. S. and R. McPherson	Antimony	1,980.00	2,640.00
Newman, H. P.	Copper	1,890.00	3,780.00
Nevada Uranium Co.	Uranium	8,230.50	9,145.00
Hamilton Consolidated Mines Corp.	Lead-Zinc	13,370.00	26,740.00
Grand Deposit Mining Co.	Lead-Zinc-Copper	13,200.00	26,400.00
Walker Corp.	Lead-Zinc-Copper	66,155.00	132,310.00
Baltimore Camas Mines, Inc.	Tungsten	15,210.00	20,280.00
Cherry Creek Tungsten Mining Co.	Tungsten	56,250.00	75,000.00
Graham Development Corp.	Tungsten	12,840.00	17,120.00
M. I. A. Mines Co.	Tungsten	128,550.00	171,400.00
Mt. Wheeler Mines, Inc.	Tungsten	56,607.00	75,476.00

Name	Commodity	Gov't Part.	Total Value
NEW HAMPSHIRE			
Alstead Mica Miners, Inc.	Mica	5,040.00	5,600.00
Berry, R. N.	Mica	13,050.00	14,500.00
NEW JERSEY			
Busche, F.	Graphite	925.00	1,850.00
Warren Foundry & Pipe Corp.	Iron	141,850.00	283,700.00
NEW MEXICO			
Mathis, R. W. and L. Mac	Lead-Zinc	14,200.00	28,400.00
U. S. Smelting, Refining & Mining Co.	Lead-Zinc	290,921.50	581,843.00
Peru Mining Co.	Lead-Zinc-Copper	112,500.00	225,000.00
Black Hawk Consolidated Mines Co.	Uranium	18,000.00	20,000.00
Moseley, I. L.	Copper	21,000.00	42,000.00
Clark & Mathis	Lead-Zinc	6,327.00	12,654.00
Byrne, V.	Lead-Zinc	12,369.00	24,738.00
Potter and Sims	Tungsten	58,140.00	77,520.00
NORTH CAROLINA			
C. C. Burleson	Mica	2,389.50	2,655.00
Powder Mill Mining Co.	Mica	2,808.00	3,120.00
Trammell Mining Corp.	Mica	3,060.00	3,400.00
S. K. Vance & R. B. Guy	Mica	6,210.00	6,900.00
D. Robinson & H. C. West	Mica	8,460.00	9,400.00
The Hitchcock Corp.	Talc	29,267.10	32,519.00
Rex L. Boone	Mica	3,600.00	4,000.00
R. C. Burns & R. Spangler	Mica	6,030.00	6,700.00
Forest City Mining Co.	Mica	6,615.00	7,350.00
F. B. Hendricks	Mica	3,150.00	3,500.00
F. B. Hendricks	Mica	2,250.00	2,500.00
F. B. Hendricks	Mica	1,440.00	1,600.00
F. B. Hendricks	Mica	3,780.00	4,200.00
F. B. Hendricks	Mica	1,350.00	1,500.00
F. B. Hendricks	Mica	2,160.00	2,400.00
L. Schmitt	Mica	3,240.00	3,600.00
Gaston Strategic Minerals Co., Inc.	Mica	5,040.00	5,600.00
F. O. Phillips	Mica	6,210.00	6,900.00
Piedmont Minerals	Mica	11,160.00	12,400.00
F. Arrowood	Mica	5,760.00	6,400.00
H. R. H., Inc.	Mica	4,590.00	5,100.00
H. R. H., Inc.	Mica	4,995.00	5,550.00
E. L. and R. W. Poston and J. H. Howell, Jr.	Mica	9,180.00	10,200.00
C. Revis	Mica	2,970.00	3,300.00
Dixie Minerals, Inc.	Mica	3,600.00	4,000.00
Dixie Minerals, Inc.	Mica	4,140.00	4,600.00
Olivine Products Corp.	Nickel	13,852.80	15,392.00
Zeb Angel	Mica	6,210.00	6,900.00
Bauer Mining Co.	Mica	8,190.00	9,100.00
F. D. Cabe	Mica	4,396.50	4,885.00
L. Carpenter, N. Mashburn, J. Phillips	Mica	6,120.00	6,800.00
L. Carpenter, J. Buchanan & N. E. Mashburn	Mica	4,680.00	5,200.00
Enloe, H. E.	Mica	450.00	500.00
Enloe, H. E.	Mica	2,934.00	3,260.00
Enloe, H. E.	Mica	1,800.00	2,000.00
Franklin Developers, Inc.	Mica	3,240.00	3,600.00
Judson, F. A.	Mica	1,575.00	1,750.00
Keller, Caleb, J. Crossnore	Mica	5,850.00	6,500.00
Meadows, H. C.	Mica	2,750.40	3,056.00
Mica Development Corp.	Mica	5,400.00	6,000.00
Polly Miller Mining Corp.	Mica	6,930.00	7,700.00
Penland, L. S.	Mica	450.00	500.00
Phillips, S. L. & John, Carpenter Lin	Mica	4,050.00	4,500.00
Pitt Mica Corp.	Mica	2,371.50	2,635.00
Reid, A. W.	Mica	1,710.00	1,900.00
Reid, A. W. and Hooker, W. H.	Mica	1,170.00	1,300.00
Roper, W. H.	Mica	3,600.00	4,000.00
Toe River Mining Co.	Mica	4,050.00	4,500.00
Ward, A.	Mica	3,420.00	3,800.00
Wilson, F. & Van Werry, J.	Mica	3,600.00	4,000.00
Zachary, E. H.	Mica	2,434.50	2,705.00
Baker, R.	Mica	6,633.00	7,370.00
Buchanan, O. L. & I.	Mica	3,420.00	3,800.00
Ernest Mica Co., Inc.	Mica	1,170.00	1,300.00
Phillips, F. W.; Thompson, S. W.; Ellis, C. W.; & Grindstaff, R.	Mica	31,680.00	35,200.00
Covington, W. H.	Mica	1,341.00	1,490.00
Tamarack Mining Co.	Mica	2,043.00	2,270.00
Robinson, H. I.	Mica	3,352.50	3,725.00
Anglin, K. L. & J. Elkins	Mica	6,750.00	7,500.00
Chrisawn, W. B. & H. Gibbs	Mica	2,880.00	3,200.00
Grigg and West Co.	Mica	8,685.00	9,650.00
Ray, B. L. & Hyde, C. E.	Mica	3,645.00	4,050.00
Yancey Mica Mines, Inc.	Mica	14,543.16	16,159.00
Yancey Mica Mines, Inc.	Mica	13,117.50	14,575.00
Yancey Mica Mines, Inc.	Mica	3,690.00	4,100.00

Name	Commodity	Gov't Part.	Total Value
OKLAHOMA			
American Zinc, Lead & Smelting Co.	Lead-Zinc	78,000.00	156,000.00
OREGON			
Wise, P.	Antimony	26,045.25	33,727.00
SOUTH CAROLINA			
Callahan Zinc-Lead Co., Inc.	Monazite-Columbium-Rutile	17,802.19	57,593.00
SOUTH DAKOTA			
Campbell, G. R. & Venthing, G.	Beryl-Mica	5,895.00	6,550.00
Collingwood, L. W.	Beryl-Mica	9,000.00	10,000.00
Collingwood, L. W. & D. W. & McDermand, D. B.	Beryl-Mica	4,725.00	5,250.00
Duncan, F. E. & Himebaugh, E. B.	Beryl-Mica	2,700.00	3,000.00
Wiehe, C. L. & B. A. Gara	Beryl-Mica	6,017.40	6,686.00
Pitts, L. D.	Beryl-Mica	5,373.00	5,970.00
Whitehead, E. & G. R. Smith & G. Walker	Beryl-Mica	8,010.00	8,900.00
McHenry, R. H.	Columbium-Tantalum	3,184.20	3,538.00
Mineral Mills, Inc.	Mica	1,080.00	1,200.00
Belle Eldridge Gold Mines, Inc.	Lead-Zinc	5,800.00	11,600.00
Keenan Properties	Tin-Columbium-Tantalum-Tungsten	90,000.00	100,000.00
Black Hills Keystone Corp.	Beryl-Mica	12,600.00	14,000.00
Black Hills Keystone Corp.	Beryl-Mica	20,772.00	23,080.00
Stewart, J.	Beryl-Mica	14,192.10	15,769.00
TENNESSEE			
King, L. W. & Scott, C. K.	Cobalt	6,768.00	7,520.00
TEXAS			
Maravillas Minerals Co.	Mercury Ore	7,837.50	10,450.00
National Lead Co.	Sulphur	48,839.50	97,679.00
Carr Mining Co., Inc.	Lead	5,197.50	10,395.00
Amerimex Mining Co.	Mercury	60,000.00	80,000.00
UTAH			
F. Staats	Fluorspar-Uranium	17,500.00	25,000.00
Harrington Mines Co.	Lead-Zinc	62,620.00	125,240.00
Canary Mining Co.	Uranium	24,052.50	26,725.00
Excalibur Uranium Corp.	Uranium	53,363.70	59,293.00
Hunt, K. & A.	Uranium	6,631.20	7,368.00
Morgan, F. L. & E. R.	Uranium	2,106.00	2,340.00
Excalibur Uranium Corp.	Uranium	34,410.00	38,233.00
Boomerang Mining Co.	Uranium	21,795.84	24,117.60
Duke Page Auto Co.	Lead	8,853.50	17,707.00
Privateer Mining Co.	Lead	4,031.00	8,062.00
Chief Consolidated Mining Co.	Lead-Zinc	231,710.00	463,420.00
Salina Mining & Smelting Co.	Uranium	15,255.45	16,950.50
Garrick, Louise W.	Tungsten	20,025.00	26,700.00
Bullion Monarch Mining Co.	Uranium	24,957.00	27,730.00
Glenn Mining Co.	Uranium	20,875.50	23,195.00
Glenny, R. A. & Cutler, S. M.	Uranium	22,050.00	24,500.00
Sunnyside Uranium Co.	Uranium	39,114.00	43,460.00
Combined Metals Reduction Co.	Lead-Zinc	27,550.00	55,100.00
United States Smelting, Refining & Mining Co.	Lead-Zinc-Copper	74,762.50	149,525.00
Duncan, J. W., Jr.	Uranium	38,871.00	43,190.00
Ellihill Mining Co.	Uranium	17,145.00	19,050.00
Moreno Cripple Creek Corp.	Uranium	19,260.00	21,400.00
Shumway, J. G. & G. L.	Uranium	4,050.00	4,500.00
White Canyon Mining Co.	Uranium	47,138.40	52,376.00
Plateau Mining Co.	Uranium & Vanadium	17,049.60	18,944.00
New Quincy Mining	Lead-Zinc	25,350.00	50,700.00
Silver King Coalition Mines Co.	Lead-Zinc	160,767.03	321,534.06
Combined Metals Reduction Co.	Lead-Zinc	111,000.00	222,000.00
United Mining Development Co., Inc.	Lead-Zinc	8,274.00	16,548.00
Woodman, Cecil R.	Tungsten	9,284.25	12,379.00
Cleghorn, Willard	Lead	9,177.00	18,354.00
American Fork Consolidated Mines	Lead-Zinc	8,019.00	16,038.00
U. S. Smelting, Refining & Mining Co.	Lead-Zinc	308,677.50	617,355.00
West Park Mining Co.	Copper	8,100.00	16,200.00
New Park Mining Co.	Lead-Zinc	117,197.60	234,395.20
Naildriver Mining Co.	Lead-Zinc	20,000.00	40,000.00
Park Utah Consolidated Mines Co.	Lead-Zinc	89,994.00	179,988.00

Name	Commodity	Gov't Part.	Total Value
UTAH (continued)			
East Utah Mining Co.	Zinc-Lead-Copper	54,587.00	109,174.00
Park Heber Consolidated Mining Co.	Lead-Zinc-Copper	13,500.00	27,000.00
Park Utah Consolidated Mining Co.	Zinc Ores	21,000.00	42,000.00
Kentucky-Utah Mining Co.	Lead-Zinc-Copper	17,500.00	35,000.00
J. R. Simplot Co.	Uranium	64,340.48	71,489.42
VERMONT			
Ruberoid Co.	Asbestos	56,250.00	62,500.00
Vermont Copper Co., Inc.	Copper	25,691.00	51,382.00
Ruberoid Co.	Asbestos	64,440.00	71,600.00
VIRGINIA			
Belville Gold Mines, Ltd.	Lead-Zinc	14,125.00	28,250.00
Old Dominion Manganese Co., Inc.	Manganese	29,700.00	39,600.00
WASHINGTON			
S. J. Holden and Associates	Copper	3,800.00	7,600.00
Black Warrior Mining Co.	Lead, Zinc, Copper	25,123.75	50,247.50
Spokane Mining Syndicate, Inc.	Copper, Zinc	22,000.00	44,000.00
O. Aavestrud & C. J. Weller	Tungsten	24,525.00	32,700.00
Western States Copper Corp.	Copper	11,150.00	22,300.00
G. O. P. Antimony, Inc.	Antimony	17,400.00	23,200.00
G. O. P. Antimony, Inc.	Antimony	12,060.00	16,080.00
American Zinc, Lead & Smelting Co.	Lead-Zinc	60,000.00	120,000.00
American Zinc, Lead & Smelting Co.	Lead-Zinc	58,250.00	116,500.00
Jim Creek Mines, Inc.	Lead-Zinc	23,750.00	47,500.00
Mount Rainier Mining Co.	Copper & Molybdenum	1,500.00	3,000.00
C. O. Davis	Lead	21,375.00	42,750.00
R. T. Curtiss and J. C. Rogers	Copper	8,800.00	17,600.00
Index Mining Co.	Copper	57,500.00	115,000.00
L. Hammond	Beryl	15,075.00	16,750.00
Farmer Mine Enterprises	Lead-Zinc	5,000.00	10,000.00
The Goldfield Consolidated Mines Co.	Lead-Zinc	11,527.50	23,055.00
Mines Management, Inc.	Lead-Zinc	29,575.00	59,150.00
Pacific Northwest Mining Co.	Lead-Zinc	18,642.00	37,284.00
Pioneer Mining Co., Inc.	Lead-Zinc	11,825.50	23,651.00
Mines Management, Inc.	Lead-Zinc-Cadmium	12,000.00	24,000.00
Addy Mining Co.	Tungsten	15,967.50	21,290.00
Tungsten Mining & Milling Co.	Tungsten	25,987.50	34,650.00
T. Nasburg, et al.	Zinc	14,630.00	29,260.00
Glacier Mining Co., Inc.	Copper	3,707.50	7,415.00
R. R. Whiting, Jr. and M. P. Roumm	Mercury	13,818.75	18,425.00
WISCONSIN			
E. P. Scallon	Lead-Zinc	3,750.00	7,500.00
D. H. & S. Mining Co.	Lead-Zinc	14,577.00	29,154.00
Dodgeville Mining Co.	Lead-Zinc	3,000.00	6,000.00
Dodgeville Mining Co.	Lead-Zinc	3,750.00	7,500.00
Dodgeville Mining Co.	Lead-Zinc	3,750.00	7,500.00
Dodgeville Mining Co.	Lead-Zinc	5,000.00	10,000.00
Dodgeville Mining Co.	Lead-Zinc	5,000.00	10,000.00
Dodgeville Mining Co.	Zinc	4,020.00	8,040.00
Calumet & Hecla Consolidated Copper Co.	Lead-Zinc	155,215.00	310,430.00
Eagle Picher Co.	Lead-Zinc	95,615.39	191,230.78
Mayer & Thiede Mining Co.	Lead-Zinc	5,000.00	10,000.00
Vinegar Hill Zinc Co.	Lead-Zinc	34,220.19	68,440.38
Vinegar Hill Zinc Co.	Lead-Zinc	7,820.05	22,343.00
Star Mining Co.	Asbestos	4,500.00	5,000.00
WYOMING			
K. L. Porter	Sulphur	49,575.00	99,150.00
Continental Sulphur & Phosphate Corp.	Sulphur	39,705.00	79,410.00
ALASKA			
Tillicum Mining Co.	Antimony	18,521.25	24,695.00
Admiralty Alaska Gold Mining Co.	Cobalt-Nickel	108,000.00	120,000.00
United States Tin Corp.	Tin	203,400.00	226,000.00
Zenda Gold Mining Co.	Tin	108,000.00	120,000.00
Alaska Copper Corp.	Tungsten	30,750.00	41,000.00
Alaska Copper Corp.	Copper	56,274.00	112,548.00
C. Wren, F. Waskey & C. Wolfe	Mercury	19,210.50	25,614.00
E. R. Pilgrim	Antimony	46,500.00	62,000.00
I. W. & S. E. Purkeypile	Tin	16,200.00	18,000.00
Alaska Metals Mining Co.	Tungsten	133,675.50	178,234.00

SMALL MINES

Low in unit output, but unmatched in faith and courage, the industry's small enterprises collectively play an indispensable role in building a sound future for mining

In this 12-page section you will find:

- **A report on one Government activity that has helped small mines.**
- **A round-table discussion of the small miner's problems.**
- **Suggestions for their alleviation.**

How the DMEA Is Aiding Exploration

THE MINERAL EXPLORATION PROGRAM of the Defense Minerals Exploration Administration, now two years old, is just reaching it productive stage. It is proving its benefit to the taxpayer with the passing of each additional month.

Two years ago, on May 16, 1951, Contract No. 1 was executed between the Government and an operator. It involved a diamond drilling program to prove extensions of lead and zinc orebodies. It is one of the group comprising 55% of all contracts executed by DMEA to date which entail project costs of less than $25,000.

Work under the contract began May 23, 1951, and continued uninterruptedly until 100% complete in January 1952. On the basis of the operator's final report, a certification of discovery or development was issued by DMEA in July 1952.

In the past 12 months the number of active contracts has increased from 252 to 329. New approvals nearly offset contract terminations, and the program is now characterized by vitality and soundness.

By May 31, 1953, DMEA had executed 498 exploration contracts, and 14 others were approved and awaiting signatures of the operators. The 512 project approvals have resulted from 1,865 applications received during the entire period. Of this total, 781 applications were rejected and 327 applications were withdrawn by the operators.

As of May 31, 1953, DMEA had 259 cases pending, of which 93 were in the final stages of processing in Washington and 135 had undergone preliminary review.

The 498 contracts executed involve the search for more than 26 critical and strategic minerals in 31 states and Alaska, and have an aggregate approved project cost of $24,396,489, of which the Government has agreed to contribute $14,696,933. Only $6,746,136 of Government funds has been spent, however, in these two years of operation, and the greater part of the sum disbursed has been on projects which are still active and will not be brought to completion for months. Of the 498 exploration contracts executed, 127 were completed and terminated as of June 1, 1953. A total of $868,172 of Government funds has been spent on these projects. Forty-eight certifications of discovery or development have been issued, officially recording success in the finding of a dozen strategic and critical minerals.

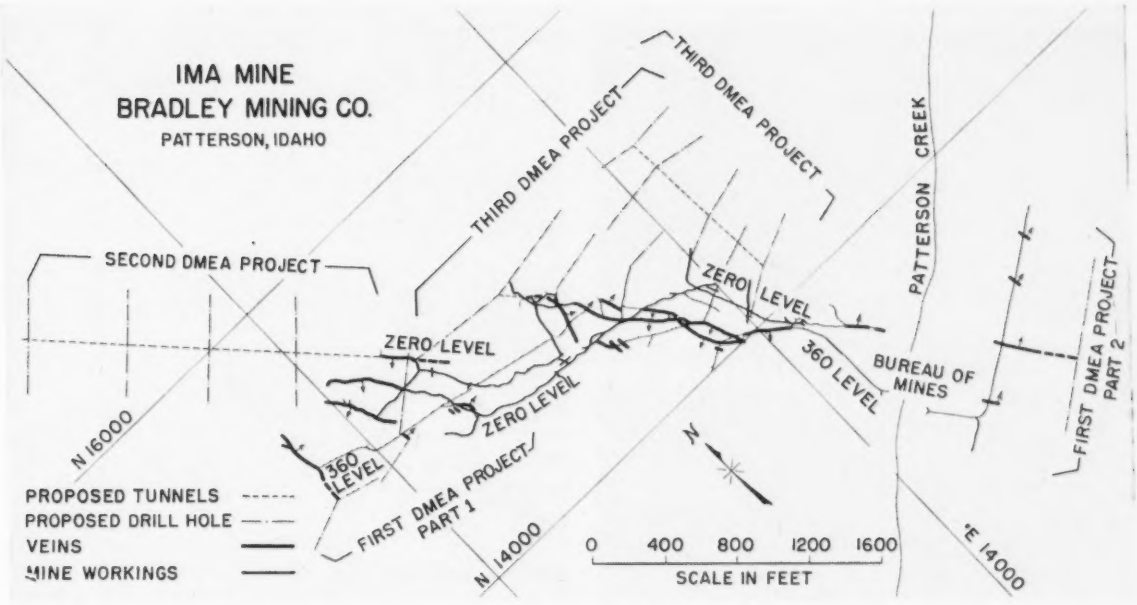
It is noteworthy that records covering the 127 terminated projects indicate that 86% of the Government funds allocated for work on successful projects was actually disbursed, whereas only 44% of the funds allocated to unsuccessful projects was spent. This interesting observation reflects the vigilance and cooperation of the DMEA field teams and the operators in closely appraising the results of the work and agreeing to halt exploration expense as quickly as it is recognized that further operations are not justified.

Ore has already been found on 120 projects, and 53 of these have entered production. Forty-eight operators have begun royalty payments to the Government in repayment of advances totaling $60,172 and representing a gross net smelter value for ore already marketed of $1,203,440.

In accordance with the basic objectives of the exploration program, the amount repaid to the Government for its contribution to the cost of the projects must be considered largely incidental, and not a measure of its success. Some deposits not presently amenable to production for economic reasons may become of primary significance during periods of extreme emergency.

DMEA's experience thus far reveals that 73% of all contracts executed to date entail project costs of less than $50,000 each, and that the aggregate participation in these contracts accounts for about 42% of the total Government funds approved under the program. **This situation tends to reflect the fact that the majority of domestic deposits of minerals historically in short supply are not readily distinguishable in magnitudes which justify large-scale exploration and development programs. Certainly, the program is particularly beneficial to the small operator.**

Exploration operations for many of the critical metals and minerals require special experience and technology which are not widely available, even in the case of the larger mining concerns. It is here that the technical personnel of the U. S. Geological Survey and the Bureau of Mines, who supervise work in the field, contribute valuable service to the small operator by guiding his project work intelligently.



THREE DMEA PROJECTS at the Ima Mine are aimed at establishing additional reserves of high-grade tungsten ore.

How DMEA Helped the Ima Mine

After looking over the impressive list of mine operations that have sought DMEA assistance, pages 150A and 150B, you may logically inquire about the progress of these projects. So did E&MJ, and here is a case history telling how important strategic mineral resources have been developed at the Ima mine through the workings of the DMEA program.

AMERICA'S FIFTH LARGEST domestic tungsten producer, the Ima Mine, is located near Patterson, Lemhi County, Idaho. Holdings of the company include 45 patented claims, 56 unpatented claims and other tracts in the Pahsimeroi Valley.

Bradley Mining Co. took over the Ima mine in January 1945 under a lease-and-option contract. Purchase terms of this contract should be completed within the next two years, when Bradley Mining Co. will have complete title to the original Ima property. The adjoining Miller mine, formerly owned by the General Electric Co. (presently Tungsten Mining Corp.) was also leased with an option to purchase shortly after Ima negotiations were concluded. The name Ima mine now applies to both properties.

Ima mine started producing in 1937, and to date approximately 500,000 tons of ore have been mined yielding slightly less than 200,000 short ton units of WO_3, plus substantial values of silver, lead, and copper.

The hubnerite concentrate produced at the Ima mine has gained recognition as one of the purest tungsten concentrates available in the world. Demand for this type of concentrate is steadily growing for the processing into powder and production of such products as tungsten carbide, tungsten filaments for lamps and tubes, electrical contacts, etc. Ima hubnerite concentrates are of uniform high quality and contain about 72% WO_3 with very low content of impurities (less than 0.01% each of molybdenum and phosphorus).

Entire output of the Ima mine has been going to industry and none has been sold to the Government under the $63 floor-price program.

Ima's 160-ton concentrator is primarily a gravity concentrator, although the sulphide values are recovered by flotation.

Vein systems at the Ima mine have been developed and exposed by underground workings for a length of over 4,000 ft., and a vertical distance of more than 500 ft. The width across which the more or less parallel vein systems occur is nearly 1,000 ft. in some areas. Limits of the ore zone beyond these distances have not yet been found, but indications are that extensions are substantial, and that the Ima mine will have a long life.

In order to determine the longer range possibilities of the Ima mine, several exploration projects have been undertaken with the aid of the Defense Minerals Exploration Administration. The first two of these projects were developed cooperatively with A. E. Weissenborn, DMEA executive officer, and his staff; and also consulting geologist, Carlton D. Hulin. The third project was planned by the Ima staff, C. C. Hatthorn, manager; Charles Winterhalder, engineer; and Roger H. McConnel, consulting geologist; in cooperation with A. E. Weissenborn of the DMEA and his staff.

The first project which started in two parts (see map) was begun in

CLOSE-UP of mine, portal, trestle, and mill (foreground).

THE IMA MINE lies in this rugged mineral frontier.

1951. Part one involved 2,500 ft. of drifting in a northwesterly direction on the main haulage level to explore an area about which very little was known. Strong flat and inclined faults complicating the area did not permit projection of any known ore structures into the area. Exploration was therefore in virgin territory. This phase of the project was completed by the end of 1952, with the result that three strong tungsten veins were discovered and well exposed.

Part two of the first project was aimed at locating the extension of the Ima vein system south of Patterson Creek—on the opposite side of the canyon from the main Ima mine. This project involved diamond drilling from the surface, to be followed, if warranted, by underground crosscutting and drifting to confirm diamond drill results. This phase of the project involved 1,500 ft. of lateral underground work, and is now nearing completion. One fairly strong tungsten vein has already been exposed for a length of more than 250 ft., and several smaller veins have also been encountered which will be still further explored by diamond drilling.

The Government's loan contribution to both phases of the first DMEA project totaled $91,800. Repayment of the Government portion is already in progress, and through March 1953, $6,400 has already been repaid through royalties from production.

The second main DMEA project for the Ima mine was approved Oct. 28, 1952. This program involved extension of the main upper level (the Zero level, 360 ft. above the haulage level) 2,000 ft. in a northwesterly direction. Following this, 1,000 ft. of exploratory drifting and crosscutting, and 2,000 ft. of diamond drilling, have been provided. The Government's participation in this project amounts to $84,000.

Objectives of the second project are to explore the intervening area along the 2,000-ft. drive, and the zone at the northeasterly end of the projected work. There, more than ten years ago General Electric Co. drove a long crosscut adit towards the target area now involved. From the face of this adit, a long diamond drill hole was run. Ore discovered in this hole strongly indicates that the zone of excellent mineralization now exposed at the northwesterly end of the Zero level extends 2,000 ft. further to the northwest. This second exploration program now under way should prove or disprove this hopeful contention.

The third project for the Ima mine is aimed at determining the width of the zone in which the Ima veins occur. This exploration will cover about 3,000 ft. perpendicular to the strike of the veins.

What Ima's Management Thinks of DMEA

"Our experience with DMEA has given us good cause to be highly enthusiastic about the practical working procedures and worthwhile objectives of the DMEA program, and to appreciate the high calibre of DMEA personnel with whom we have worked – in particular A. E. Weissenborn and his staff.

"In general, it is our contention that the DMEA program is one of the most logical and constructive ever to be enacted for the natural resource industry. Not only is greatly needed exploration encouraged, but–more important–when such exploration proves successful, the Government is repaid to the extent of its dollar contribution.

"Our belief in the long-range benefits of this program to our national welfare is so great that we have recently applied for two additional exploration project contracts – one at our Springfield tungsten mine, Stibnite, Idaho, and the other for a third project at the Ima mine."

Problems Facing Small Mines And How They May Be Solved

No better qualified group of men could be found to discuss the problems of small mines than the panel we present in the following pages, the executives of several of the Western mining associations

ARIZONA—*"They must have a stable market for their products."*

ROGER I. C. MANNING*
Director,
State Department of
Mineral Resources
Phoenix, Ariz.

TO PARAPHRASE an old saw, "Mighty mines from little prospects grow." All the big copper mines in Arizona were once little prospects, discovered and located by individual prospectors. To be sure, today the small copper mine is not contributing very much to the State's output, but it is of chief importance as the producer of fluxing ores needed in the smelting of concentrates produced by the big low-grade copper mines. The big mines need them, and for that reason big companies are interested in seeing small mines prosper.

Large mines, through their smelters, can help the small miner by providing a market for small shipments of ores, by making cash advances for fluxing ores, and by providing technical assistance.

The small lead and zinc mines of the State have been going through the stage of growth during the last 25 years that the copper mines went through at the turn of the century. However, because of their geological nature, the lead-zinc deposits are not conducive to the mass-production technique of the copper deposits.

Their production is nevertheless important to the economy of the nation. Lead and zinc are essential elements in the defense of the country, and these small lead and zinc mines deserve encouragement from the powers at Washington when they seek protection against dumping of foreign metals.

They must have a stable market for their products, for most of them cannot stand even a temporary discontinuance of mining operations, with its accompanying deterioration of mine and equipment. The shutting down of the great majority of the lead-zinc mines in the State is a tragic commentary on Washington's neglect.

Arizona is handicapped in developing its lead-zinc mines by the lack of a smelter. Capital investment for such a plant will not be forthcoming while the market for lead and zinc is so unstable.

Manganese production in Arizona has been helped by establishment of a government buying depot at Wenden, Ariz. Similar provision for tungsten purchasing would greatly encourage production of that metal by Arizona's small properties.

The Atomic Energy Commission is carrying out various activities on a large scale in Arizona, directed toward finding more uranium ore. Men are assigned to various parts of the State to cover favorable areas, follow leads furnished by prospectors, and examine promising deposits.

Gold mining, however, has never recovered in Arizona from the blow dealt it by the famous closing order, L-208, which the government inflicted on it in 1942. In 1941, there were 471 gold mines operating in Arizona, producing 130,298 oz. for the year. In 1951, only 31 gold mines were left. Their output was 1,085 oz. Including silver, the number of mines has dwindled from 594 in 1941 to 62 in 1951, with a total output of 1,933 oz. of gold and 248,210 oz. of silver. The 1941 figures for mines producing gold, silver or both were 144,198 oz. of gold and 1,195,814 oz. of silver.

Clearly, if gold mining were again to become profitable, it would have a most salutary effect on our small mines and on the State, itself.

(*Continued on next page*)

* In this instance, Mr. Manning is acting also as spokesman for the Arizona Small Mine Operators Association.

COLORADO—*"The answer is, give the small miner a break."*

ROBERT S. PALMER
Executive Director
Colorado Mining Association
Denver, Colo.

THE MINING ENGINEER sent out by a major company is anxious to protect his reputation. He studies the history of a district, and he may find that little if any production has taken place there. Naturally, he shies away from it, for if he should recommend it to his company, he may waste valuable stockholders' money. It's safer to turn the property down.

The little miner, however, is looking for his livelihood. He is not satisfied to work for others, he wants to become an independent entrepreneur. He searches diligently in places where it may be difficult for trained personnel from major companies to prospect.

True, modern methods are not always available to the small miner, and scientific methods have in some instances led to ore that was overlooked by small operators. On the other hand, many new mines have been brought into being by the sheer determination of the little guy.

It's a mistake to say that the prospector no longer exists, because in Colorado, at least, he does still exist. He is uncovering mines overlooked by his predecessors. The Big Four mine on Blue River in Summit County, the uranium orebodies found by Navajos in areas where scientific advisers were doubtful, discovery of gold in Cripple Creek by an independent in "worked-out" property, are but a few illustrations of the essential job small operators can do.

Mining's leaders are cognizant of the influence of politics on successful mining. When the political pendulum swings far to the left, the first attack is made on major segments of the industry. Who, then, is expected to come to the rescue on a political basis? Is it not the small miner who enjoys a sympathetic understanding on the part of his many friends in the communities in which he resides?

It should be in the nature of self-interest for the major companies to encourage the smaller operator, because the more operations there are, the better chance there is to save the industry from socialization.

Despite the little miner's major problems, as for example, the shortness of the frayed shoestring on which most of them have to operate, it is true that he will often take chances that, under present economic conditions, the larger concern cannot take. In Colorado's uranium country, few major concerns are willing to start preliminary examinations in this mountainous area. Several capable little fellows, on the other hand, are locating claims, trenching, tunneling, and exploring potential orebodies that may have real significance at a later date.

Don't forget, however, that the little fellow must be highly efficient in his work or he is out of business. The high-grader is the exception.

It is the contention here that small mining companies should pool their interests in purchasing supplies, in getting discounts from supply houses, and even in securing various items, such as food and clothing needed for maintenance. It is also suggested that in cooperating on such a program, other savings can be made, such as more favorable contracts with smelters and mills, and even railroads or power companies.

The catch is that small miners are individualists, each with his own orebody, his own ideas, and his own problems. There is, nevertheless, an opportunity for pioneering in this field, even to the extent of employing one engineer or geologist for consultation on a group of several individual properties.

Small mines can also serve as training grounds for miners. I have noted that many little mines have trained good miners who later on found employment in the larger mines.

The big mining companies can, and often do, help the little fellows to the extent of showing them the way to prospect for and develop an orebody. They can give advice on how best to use their powder effectively, the best form of drill steel, the cheapest operating equipment, and all of the other items that experience teaches are used by successful operations.

Now, as to what government should do to aid in opening and developing small mines, the answer is, give the small miner a break. Give him an incentive. The Congress has taken definite steps in that direction in granting a $75,000 exemption for exploration work in the Federal Revenue Act. But unfortunately, the small miner is still unable to compete effectively with his bigger brother on a per pound of metal basis.

When Secretary Douglas McKay suggests that the marginal segment of the mining industry be eliminated in an effort to readjust price structures and market conditions, he is saying in effect that small business in the mining industry is not desirable. By the same reasoning, efficiency experts might eliminate the youth of our country and kill off the children because a child is expensive to maintain, to bring up, and to train for the businesses of the future. This is what Mr. McKay is saying when he wants to eliminate the marginal miner because the marginal miner does have to have the help of his government.

It would be a fine thing if the miner could be assured of a base price for his products and elimination of the feast-and-famine treatment. It would be in the national interest to encourage the small miners to invest their savings in the search for ore.

A high public official recently said to me, "Tell your miners to invest their savings in Government bonds." This, in my judgment, is the opinion of a swivel chair artist who, having made his, is willing to discourage others from making theirs. Is the graduate of the mining school of the future to seek employment only with the major

concerns of the United States? Is there to be no future for the individual who wishes to search for ore for himself and a small group of his friends? Is small business to be so chastized that it cannot survive?

It is in the national interest that there be no division in the mining industry. It is far more important to bring about understanding among mining people than it is to try and work out the problems of the big and little operators separately. But by the same token, it is not generally true that a solution which is good only for a major segment of the industry is the final answer to any problem.

It becomes more apparent as various studies are published that metal requirements in the future will probably be greater than they are today, and that if we are honestly looking to the future, we will take steps inside and outside government that wil honestly offer proper incentives to miners to get out and develop new orebodies. The problem requires vision, it requires broad-gauged experience; it requires wisdom such as few men in the industry enjoy today.

It requires more than a mere executive's decision; it requires a comprehensive, analytical study of the entire problem. It suggests that unless the study is completed prior to the death of the small miners of this country, there will be no future development of any consequence in many mineralized areas.

IDAHO—*"Subsidized operations abroad are forcing (us) to shut down."*

HARRY W. MARSH
Secretary,
Idaho Mining Association
Boise, Idaho

BECAUSE MANY of the mining operations in the area covered by the Idaho Mining Association could be classed as small mines, our group is constantly alert to the special needs and problems of the smaller mining enterprise.

Ordinarily, I would be in complete sympathy with, and would gladly engage in, a general discussion of the position of small mines in the industry as a whole.

Now, however, the crisis that confronts the Idaho mining industry is so acute, and is so limited in its cause, that I find it difficult to engage in discussion beyond the outstanding point that a flood of imported metal is threatening to bring our lead-zinc mining industry to a halt.

Cheap labor and subsidizations of operations abroad (much of it done with the U.S. taxpayer's money) are forcing our operators to shut down and remove our miners from their jobs. Over 600 men have been laid off in the Coeur d'Alenes alone.

All the Pine Creek properties are down. The Sullivan zinc plant is on a 40% of capacity basis. The situation is growing steadily worse. When cash balances at our properties are gone, there will be nothing to do but put big signs on their doors saying, "This mine closed because of imports."

For suggestions on what should be done about this situation, I can do no better than offer some of the ideas of three of our members who gave statements on April 27, 1953 in Spokane before the special House Subcommittee on the problems of small businesses.

HENRY L. DAY, President
Day Mines, Inc.
Wallace, Idaho

SMALL MINES can't produce much longer, but their continued operation is vital.

Small mines generally lack, however, the reserve strength to maintain continuous operation through times of low metal prices like that of this year. Many of our small mines are shut down. My own company, medium in size, has cut lead output since last fall by one-tenth and zinc output by half. Our employment, normally running at 400 to 600 over the last 10 years, is down to about 270.

It must be observed that U. S. consumption of lead and zinc continues high. The low prices that beset us are due to unprecedented imports of lead and zinc in 1952, continuing into 1953 at rates of 40,000 tons of lead and 50,000 tons of zinc monthly. Two months of such imports pile up more metal than all of northern Idaho will produce in 1953.

Five remedies for this situation have been proposed. These are: 1, additional government stockpiling; 2, a sliding-scale import tax; 3, a government Metals Credit Corp., like the old but still operating Commodity Credit Corp., for agricultural products; 4, a new Premium Price Plan; 5, import quotas for metals.

Of these, none is without imperfections, none is a panacea. A solution is not easy, but the crucial circumstances demand immediate action.

L. J. RANDALL, President
Hecla Mining Co.
Wallace, Idaho

IT IS ONLY NATURAL to blame all our troubles on the comparatively recent decline in prices of metals, which certainly has wiped out the profits of most lead-zinc operations, and in many cases, surplus funds as well.

Yet we must admit that we have enjoyed fair and reasonable prices for lead and zinc for most of the 10-year period prior to June 1, 1952.

Why, then, hasn't the mine operator been able to retain enough of the profit earned in these good years to carry him through this present period of losses?

The answer is that Federal taxes have claimed such an excessive

portion of these earnings that the amount retained by the operator, after taxes, has been inadequate to provide for a rainy day. This is particularly true of the small mine operator.

Permanent, as well as temporary, alleviation of this situation should be sought, and to that end, I suggest the following amendments to our Federal tax laws.

1. Limitation on expensing of exploration costs (now $75,000 per year per company) should be removed.

2. Limitation on percentage depletion as a deduction in computing net loss carry-back and carry-over should be removed.

3. The depletion allowance should be made adequate to recover the entire cost of successful, plus the unsuccessful, mining ventures of a company.

4. New mining ventures should receive a three-year tax-free period of operation, as they do in Canada.

5. There should be a tax-free depletion allowance to stockholders in mining companies.

CHARLES E. SCHWAB
Manager of Industrial Relations
Bunker Hill & Sullivan Mining & Concentrating Co.
Kellogg, Idaho

WITHOUT DISSENT, to my knowledge, employees and their unions, communities and their civic organizations, businessmen and their associations, and managements of domestic mines are in agreement on the fact that a crisis exists in the domestic lead-zinc industry. And without dissent, they agree on its cause, excessive imports.

It is to be remembered that under conditions of recent high industrial activity, keyed to a defense economy and a stockpiling program, there is need to import about 400,000 tons of lead and 350,000 tons of zinc annually. This is, however, abnormally high. The events of the past three years show that when the consumer needs imports the most, they are not forthcoming.

And when we do not need them, they flood into the American market depressing markets and closing down domestic mines and plants.

Several remedies have been suggested. Of all the bills introduced in Congress, we favor H. R. 4294, the Simpson Bill. This bill goes directly to the solution of the problem of imports, rather than begging the question by artificial support with subsidies or special purchases.

It is just plain common sense and good practical judgment that make us believe we must keep our capacity to produce strong. We will not swallow the pill of dependency on imports. Once we reject the policy of being as self-sufficient as possible, we reject the keystone of freedom, for who can dispute the fact that for over 175 years, self-sufficiency and independence have gone hand-in-hand.

MONTANA—*"The small mine is the 'seed corn' of the mining industry"*

CARL J. TRAUERMAN
Secretary-Treasurer
Mining Association of Montana
Butte, Montana

HOWEVER GREAT THE FUTURE of the metal mining industry may be, I should like to point out that it will be the greater for the contributions of a group of healthy small mining enterprises, and it cannot but be seriously the lesser without them.

Our Association firmly believes in the need for healthy active small mines, in this nation and elsewhere in the world. Our reasons for this belief are based in part on experience and in part on recognition of the consequences of a disappearance of small mines.

Small mines are necessary because:

1. They bring into production orebodies that the large mining companies would not touch. Many large companies lose interest in a prospect unless the potential income from it runs well into the millions of dollars. This policy inevitably results in neglect of some prospects whose hidden potential is large. Small mines can bring out the real value of such properties, because their operators are willing and able to speculate against odds the large companies would never accept. Some large companies at present cannot afford such speculation on any extensive scale.

2. Small mines are a good training school for miners, engineers, and administrators. Because of the great variety of each man's duties, because of the close relationship among all the men on the job, a man learns more about mining faster with a small company.

3. If the mining industry ever develops into a wholly big-company industry, it will be relatively easy for some future socialist-minded government to nationalize it. Small mines protect both the large companies and the public against this catastrophe.

It is true, however, that life can be a lot more difficult for the small miner than it is for the large, particularly in times like the present. To some extent, small mines can help each other, first, by joining their state and national mining associations and working actively to reach their agreed-upon objectives. Second, small mines can help each other by cooperative buying of supplies, by borrowing items of equipment not in constant use, and by exchange of ideas perhaps even engaging consultants cooperatively.

Small miners should remember that good ideas are no monopoly of the big companies, and that a huge capital investment is no substitute for brains and energy.

Nevertheless, there are things that can and should be done by the

large companies, and by governments to help keep an industry of small mines in being.

Some of the large companies are aware of this need and try to meet it by special loans to small enterprises and other forms of assistance. This activity could well be expanded, as I have suggested, in the long-term interests of the big companies themselves.

Governments might well follow the example of the Canadian government which vigorously encourages small mines by tax benefits and various aids to prospectors and small operators. Gold mining, an important industry in Canada, receives a subsidy.

For my own part, considering the profitable outcome of many small mining ventures, I think a greater opportunity should be afforded the general public to share in financing small mining ventures. We have long advocated that the Securities and Exchange Commission reconsider its regulations in order to retain its function of protecting the public against swindlers but also to make it possible for the public to participate in sincere, capably-directed small mining enterprises. We believe that too strict Federal administration is denying many an individual the right to materially increase his capital through investment in mining.

Beyond that, in brief, I believe that government should give a lower tax structure to small mines than to large; that the loan activities of the Defense Minerals Exploration Administration should be made permanent; and that government should so conduct its affairs related to mining that metal markets would be stabilized rather than dislocated, as they have been of late.

Furthermore, I should like to repeat a resolution our Association adopted in January, 1953, that Congress appoint a committee consisting of members of both houses, plus gold miners and economists to study the present appalling situation in the gold mining industry of the United States and to make recommendations to revive that industry on a businesslike basis.

The nation and our industry needs the small mine, the "seed corn" of the industry. These, in brief, are the most essential means of keeping small mines alive.

NEVADA—*"Small mines need tax relief."*

LOUIS D. GORDON
Executive Secretary
Nevada Mining Association
Reno, Nev.

IT SEEMS TO ME that the question of why small mines are essential to a healthy and free mining industry answers itself. How can our industry do without a leavening of small mining activity? Small business of all kinds is essential to the economy of our nation and to the furtherance of a democratic form of government.

Small miners cannot wait, however, for someone else to solve their problems. They should be more articulate and specific in making their difficulties known to their representatives in legislatures, both state and national. They should not only join their state and national mining organizations, they should take an active part in them, especially in meetings called to work out measures for amelioration of their problems.

Perhaps a more concerted effort could be made to call the attention of the big companies to the fact that they could do more to help small mines. Big companies could make engineering and geological assistance available. Smelters taking ore shipments from small operators could make advances against receipts of such shipments in selected cases. This could be done if field men for smelters kept in touch with all small operators in the area.

Lastly, as a general proposition, I am opposed to subsidies by government, in fact to government participation in what should be the realm of private enterprise. If the government will grant a more liberal and realistic interpretation of the S.E.C. laws, and will recognize that small mines need tax relief, much will have been done. The men who made the West need only that much help, not the aid of certain "do-gooders," imbued with an academic approach to mining's problems.

NEW MEXICO—*"Big operators can help immeasurably . . . as kindred associates."*

W. P. MORRIS
President
New Mexico Mining Association
Carlsbad, N. M.

MOST MINING INDUSTRY members must have observed during their careers that large mining companies are reluctant to take on a new property unless its earning potential runs into the millions. That is why small enterprises assume an importance in the industry far beyond

their size. They provide production from small orebodies that are not economically attractive to the more conservative large operators.

By taking risks the larger companies could not take, small companies have been known to develop large reserves from apparently unimportant orebodies.

In the aggregate, small mine production contributes substantially to the nation's supply of raw materials. Also, this production is widely distributed, which lessens the effect of any possible calamity to the large operations.

Broadening the base of mining through a great many small operations would, of course, widen employment, provide excellent training for the skilled miners the industry needs, contribute a healthy stability to related communities, and stimulate public interest in mining.

There is no denying, however, that this ideal condition is difficult in the extreme to establish. Small properties have heavy going on the average, and are none too secure at best. Yet because of the obvious desirability of maintaining active small mining enterprises, it is worth considering measures that would aid in that effort.

To help themselves, small mines should pool their limited resources in research programs for the benefit of all. They should also take a more active and aggressive part in the affairs of their state mining associations, so that their problems may be presented forcefully to local, state, and national officers.

Because small operations usually depend heavily on the managerial skill of one or two men, I believe they should make a greater effort than is commonly the case to maintain qualified replacement personnel for these top jobs.

Large companies should bear, as so many of them do, much of the expense of maintaining strong mining associations for the obvious benefit of the entire industry. This is true also of research activity for mutual aid. Big operators can help immeasurably by offering technical assistance as kindred associates, rather than remaining aloof as competitors. There is a lack of unanimity on this following proposal, but the suggestion has been made that wherever possible large operators should endeavor to provide milling facilities for custom ores from small operators who are unable to build their own mills.

Lastly, there is, of course, the vast and highly controversial field of government aid to mining. Without going into direct subsidies, it seems to me that federal aid to small mines could be given most effectively through liberal loans (when competent appraisal indicated their justification), and through revision of the tax laws as applied to small mines. For example, development costs should be treated as operating expense. Depletion allowances might be increased, and special tax benefits might well be given small, or at least new, mining enterprises during the difficult initial period.

The government should stop subsidizing foreign operations that only provide unfair and ruinous competition for small domestic operators. Import duty protection has long been advocated by mining groups as an aid to the domestic industry.

Finally, I believe that stockpiling depots, strategically located to provide markets for the small operator, should be established and maintained to help provide a stable outlet for his production.

NORTHWEST—*"Tax regulations have virtually precluded growth"*

FRANK N. MARR
President
Northwest Mining Association
Spokane, Wash.

WITH CURRENT CONSUMPTION of metals at exceptionally high levels, it seems odd that small mining is completely in the doldrums. The drop in metal prices is, of course, responsible, for the small miner has little chance to accumulate sufficient reserve of capital to withstand the violent fluctuations that characterize metal markets.

The basic high risk factor inherent in mining, plus the faulty structure of our tax laws, make these wide price swings particularly damaging to the small operator.

It is important that more effective steps be taken to explain to the public the unique character of mining and the reason for special consideration of it. The good discussions that occur in our many association meetings all over the country and in the industry press are commendable, but they cannot accomplish the desired results. We are simply talking to ourselves.

Some means must be found to glamorize the story, to distribute it more widely, and to convince outsiders of the justice of our cause.

Tax regulations have virtually precluded growth of small mining businesses. Probably the worst of these is the excess profits tax, with a strong runner-up in the requirement for substantial percentage payments of earnings as dividends, when such earnings should be used for further development and strengthening of financial position. Also troublesome is the application of losses in loss years to depletion accounts prior to receiving credit as loss carryback or carry forward, as is allowed in other businesses. This constitutes a complete misunderstanding of the purpose of percentage depletion allowance.

While the purpose of the regulations governing financing of mines is admirable, they are frequently a deterrent to a small operator trying to start from scratch. Many in our area feel that this subject should not be discussed, while others feel that no satisfactory

solution has been proposed for the problem of protecting the investing public and, at the same time, permitting the flow of risk capital neccessary for mining.

The immediate problem is how to handle the transition from an inflationary economy to a more stable one. As the present administration tackles this one, we may expect to see: 1, rising interest rates, which tighten the supply of risk capital; 2, lessening of government expenditures for such things as exploration programs for minerals; 3, smaller expenditures for war materials.

All these bear heavily on the miner, yet the alternative is continued inflation and rising costs of labor and supplies. Certainly the result of all this will be to confuse, in even the more conservative minds, the thought patterns and political philosophy established in the last 20 years.

We can be sure only that if the United States is to remain the great world power that it is today, everything possible must be done to maintain a domestic supply of metals produced by a healthy growing industry. We must depend as little as possible on foreign sources in time of war.

We should eliminate the use of U. S. markets for the dumping of foreign metals. Free competition is one thing, but no one can compete with governments who are bent on unloading surplus stocks of metals.

It seems clear that without a more militant, agressive approach on the subject of public understanding of mining by our mining associations and the indiviuals who compose them, the future for the business is not bright, and our country sooner or later may be expected to pay the bill—or the penalty.

UTAH—"*We have not sold the basic importance of mining to the community.*"

MILES P. ROMNEY*
Manager
Utah Mining Association
Salt Lake City, Utah

PROSPECTING and small mining have thrived under the free enterprise system. Today, however, we can with justifiable concern seriously question the overall determination to retain that stimulating motive in our economic pattern. Certainly, in the last few decades its clarity has diminished. We can be sure only that the long-range interests of government, the people, and established mining companies will best be served by helping to assure every reasonable incentive for growth of small mines.

Prospects and small mines are the source of new ore reserves. For the mining industry to depend on present reserves or expansion of reserves in established mines and camps is much like a mercantile business liquidating present shelf and warehouse inventory after replacement from wholesale sources is no longer possible. Greatly increased small mining activity is critically needed.

Small mines, in their growth in numbers and individual size, geometrically increase the employment base of a community. In Utah, one man employed in mining creates four jobs in the community in supply and service industries. As the employed-to-population ratio is about 2.7 (260,000 employed to 709,000 population) the one man employed in mining plus the four jobs dependent on him furnishes income for 13.35 persons.

Taxes for government use are increased through small mine development and growth, through levies on personal income, property, and company profits. The mushrooming economic activity based on mining further adds to taxable income.

England's principal economic handicap today lies in her lack of raw material production and subsequent dependence on imports of raw materials for a "processing" economy. Her difficulties serve as an excellent illustration of the vital need to encourage small mining development and other raw material industries.

What are the incentives that created new economic reserves of metals through prospecting, development and expansion, or conversely, what are the existing conditions which curb or eliminate the interest in those activities? The term economic reserves of metals is used purposefully, for there are many known reserves of minerals which would become economic reserves if certain unfavorable tax practices were changed.

One basic problem is that of finance.

The prospective miner gets little encouragement when he seeks risk capital to aid him in exploring and developing his prospect.

Widely fluctuating metal prices and mine taxation provisions are probably the strongest barriers to investment in mining. Repetition of operating loss, or close-down experience, has progressively discouraged would-be investors. Conversely, in high price periods, profit is so heavily taxed that there is little left with which to finance expansion or to repay investment.

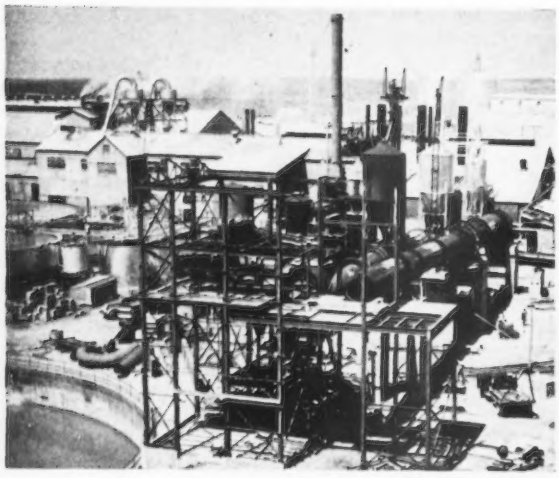
The individual who might otherwise finance risk mining ventures takes a second look after reviewing his tax position. The capital he would invest is the residue of already heavily taxed income. In making the investment he would automatically take on partners in his profits while getting that investment back, partners (tax liability) who share no portion of the risk

(*Continued on p. 308*)

* The views expressed by Mr. Romney are his own and are not to be taken as expressing the official position of the Utah Mining Association.

NON-METALLICS

Swiftly-climbing, non-metallic mineral consumption over the last decade seems only the beginning. Mushrooming new uses, plus steady growth of present markets, will challenge even the greatly expanded production facilities pictured on the following pages.

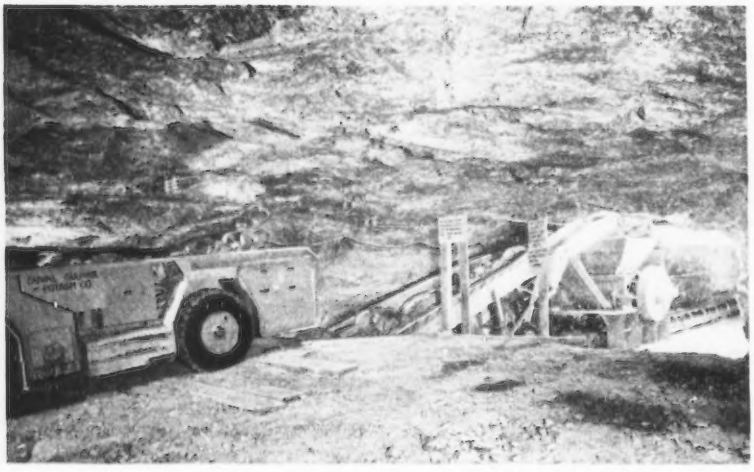


INTERNATIONAL'S NEW PLANT for MgO-HCl. Kiln, center, will run at 3,500 deg. F. to dead-burn MgO.

U.S. POTASH CO.'s new No. 3 shaft is down to salt beds. It will send men, supplies to area north of No. 1 shaft.

Potash

Growing Demand For Potash Quickens Carlsbad Expansion



DUVAL'S NEW BELT SYSTEM includes semi-portable 36x54-in. single-roll crushers discharging to 30-in. belt conveyors. As working faces advance, crushers and belts move up so shuttle cars always discharge to crusher.

A. B. CHAFETZ,
International Minerals & Chemical Corp., Carlsbad, N.M.

POST-WAR DEMANDS of the chemical and fertilizer trades have caused new development at Carlsbad, N. M., in the opening of new potash fields and expanding of existing production facilities by the operating companies in the Potash Basin. There are, at present, five operating companies engaged in producing potash and potash chemicals. One additional company is presently exploring an extensive orebody.

International Minerals & Chemical Corporation's Potash Division is approximately halfway through a $6,250,000 expansion program. The program includes a magnesium

oxide-hydrochloric acid plant, doubling of hoist capacity, expansion of the pure KCl and sulphate plants, refinery changes, a new 100,000-ton muriate storage building, and a large-scale pilot plant for the LeBaron-Lawver dry beneficiation process. Some of these units are shown in the accompanying photographs.

In the new 100,000-ton muriate storage building, 150 ft. wide and 500 ft. long, an automatic reclaiming system is being provided with large hoppers on the centerline of the long axis of the building. A conveyor belt system in tunnels will deliver material to a screening and crushing tower to be located along the railroad siding. One load-out station is being provided in the initial operation to reclaim at the rate of 250 tons per hour. Design calls for an ultimate loading rate through two stations of 500 tons per hour.

An Automatic Hoist

Hoisting equipment at the No. 1 ore shaft is to be changed during August. Electrical equipment is being provided to double hoisting horsepower. A 1,750-hp. synchronous motor-generator set will drive two 600-kw. generators. The hoist presently has one 800 hp. dc motor and will have an additional 800-hp. motor connected to it. The outstanding feature of this hoist is that the hoistman will be located at the collar of the shaft instead of in the hoist house. The hoist is completely automatic, and remotely controlled.

The new pilot plant is scheduled to go into operation during July, to operate continuously treating semi-commercial quantities of potash by means of the LeBaron-Lawver dry beneficiation process. In this process the ore is ground, dried, and given a simple and inexpensive treatment after which the ground ore is passed between electrodes. As the treated ore passes between the electrodes, it separates into various mineral fractions. The new process has been developed as the result of many years of research at International's experiment station and pilot plants at Mulberry, Fla., where large quantities of potash ore were shipped in sealed containers from Carlsbad for the experiments.

Construction of a new office building for the potash division, to be located at the mine site, will also begin during 1953.

The initial installation of belt conveyors for the underground haulage system has been completed at Duval Sulphur & Potash Company's mine near Carlsbad. The system includes semi-portable, 36 x54-inch single roll crushers discharging to 30-in. belt conveyors. As working faces advance, belts will be extended so that at all times shuttle cars will discharge directly to the semi-portable crushers. Photograph shows the semi-portable crusher station with the haulage belt leading away from the crusher.

Additional surface facilities now under construction include a second 50,000-ton production storage warehouse, a laboratory extension for research and development personnel, and an equipment warehouse. Construction contracts were awarded to the Stearns-Roger Manufacturing Company, and completion of all facilities is scheduled for late fall, 1953.

A $3-million modernization and expansion program was announced in February, 1953, by the Potash Company of America for its mine and refinery east of Carlsbad. It will extend over a period of several months. The program calls for installation of considerable new equipment designed to give greater efficiency in operations as well as to permit larger output.

The major proposed expenditure will be in the mine and will include four PCA Model 150 continuous mining machines. These machines were designed and built by PCA employees and patent applications have been filed by the company. PCA recently placed in operation four Joy continuous mining machines, and is operating a PCA experimental mining machine on a test basis. The program contemplates the purchase of several additional continuous mining machines, and extensive improvements and additions to the underground haulage system. In addition, there has recently been completed a program of modernization of equipment in the refinery which will improve recovery of potash and increase the tonnage handled.

Southwest Potash Corporation is constructing a 100,000-ton storage warehouse similar to the one being built for International.

Freeport Explores

Freeport Sulphur Company has been exploring for potash for the past three years. To date, 55 core tests have been completed. Detailed plans and estimates are being made by Freeport in order to evaluate their holdings to determine the feasibility of production of potash.

Additional plant equipment for a slightly increased production of high grade muriate and improved recoveries went into service during January and February this year at U. S. Potash Company's refinery. Changes and additions to the granular plant at the mine were completed by June 1st and the production of granular muriate of potash has been changed from a 50% product to a 60% K_2O material.

Work continued on the driving of new entries to connect the No. 1 and No. 3 shafts of the company. Ends of the new entries are presently some three miles north of the No. 1 shaft. A new 40-ton General Electric diesel-electric locomotive will be used to haul ore from the area around No. 3 shaft to the No. 1 ore hoisting shaft. No. 3 shaft will be used as a man and material shaft.

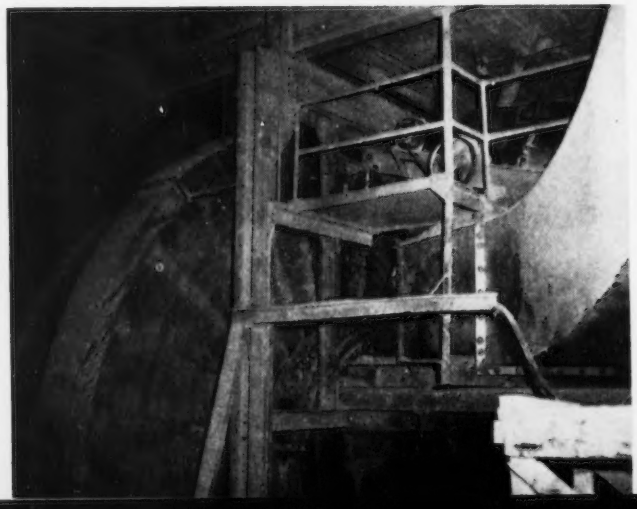
Sinking continued on the No. 3 shaft and early in June all surface beds, including water-bearing strata had been passed, with concrete lining complete to the top of the salt beds which were entered at a depth of 636 ft. Plans call for sinking this 15-ft. diameter shaft to a depth of about 1,350 ft. The shaft will be concrete lined only to top of salt.

To Summarize

Current construction and expansion programs total approximately $12-million. As mentioned before, Freeport Sulphur Company is currently evaluating their holdings near Carlsbad. International Minerals & Chemical Corp. is also doing extensive exploration work. As the demand for potash chemicals increases, there will be more activity in the Carlsbad Potash Basin to develop chemical plants and subsequent byproducts from potash brines.

JOHNS-MANVILLE is now constructing 14,000-ton mill and completing No. 2 shaft installation at Asbestos, Quebec.

JOHNSON'S CO. is completing truck garage (left), crushing plant, mill, machine shop and storage bins at Black Lake.



Major Expansion Projects Under Way for Production of Asbestos

Company and Project	Cost	Mine Capacity Tons per Day	Mill Capacity Tons per Day	Completion of Construction
Johns-Manville Co. Asbestos, Quebec	More than $20-million	25,000	14,000	1956
Asbestos Corp. Normandie Project	$11.5-million (Mill) $3-million (Mine)	5,000	5,000	1954
Johnson's Asbestos Co. Black Lake Project	$7.5-million	6,000	4,000	Late 1953
Dominion Asbestos St. Adrian, Quebec	$2-million		2,200	1953
Cassiar Asbestos McDame Lake, B.C.	$4.5-million	150 500	150 500	July, 1953 July, 1954
Provincial Asbestos Co. Coleraine Project		500 1 to 2,000	500 1 to 2,000	1953 Future
Rhodesian Asbestos, Ltd. Mashaba, South. Rhodesia		Mine #1 2,500 Mine #2 1,200	1,200	1954

Asbestos

Current and planned expansion projects may total more than $50-million in Canada alone.

CONFIDENCE that asbestos will enjoy a sustained future market is evinced by the huge construction programs of major producers in Eastern Townships, Quebec—where roughly two thirds of the world's asbestos is mined and milled. The photographs at left show what a visitor will see today. Johns-Manville is completing its new No. 2 shaft, extending mine development underground, and building a new 14,000-ton mill. Johnson's Co. is opening up a new pit at Black Lake, and constructing a 4,000-ton crushing and milling plant. Asbestos Corp. is stripping its new Normandie pit and building a new 5,000-ton mill near Black Lake. Plans for other large projects are being studied.

Ore reserves in the area are sufficient to warrant production from various mines at present or increased rates for 50 to 100 years.

Where will all of this asbestos go? Most of it will be used in the construction of industrial and residential buildings. One look at the variety of attractive asbestos products in the floors, walls, ceilings, siding and roofing of the Johns-Manville's new mine office will convince anybody that the asbestos industry has done a good market development job and intends to hold its important place in the building industry.

Pent-up demands for medium-cost housing, decentralization programs for industry, slum clearance, worldwide reconstruction programs, all work toward a long-range stability of the construction industry. New equipment operating in the high-heat range such as jet engines, high-pressure boilers, and nuclear plants all offer new outlets for asbestos. No serious concern is expressed for substitutes since in most cases the substitutes cost more than asbestos.

The following briefs are high spots in the world asbestos production industry:

Arizona. About 26 mines and mills are represented in the memberships of the Arizona Asbestos Producers Association. Early this year DMPA made its first purchase at the new Globe receiving depot.

Australia. Production is slowly increasing. Current rate is 1,000 tons of chrysotile, and 1,500 tons of crocidolite per year.

Colombia. Asbestos Colombianos S.A., with Johns-Manville participating, is exploring deposits in Antioquia.

Newfoundland. Newfoundland Asbestos, Ltd. is scheduled to start up a mill in 1953.

Ontario. Johns-Manville Munroe mine is the sole producer at about 2,200 tons per month. At least three other companies are prospecting in Ontario.

Southern Rhodesia. Value of asbestos produced in 1952 was $24-million. British Metals, Anglo-Huronian, Simon Patiño and Johns-Manville have a joint $6.5-million venture to produce asbestos at Mashaba.

Union of South Africa. Production doubled in the last three years, to a 100,000-ton annual level.

ASBESTOS CORPORATION'S new Normandie plant is now being constructed (left). Six Aerofall mills similar to one at Beaver mine (right), will be installed in the new Normandie asbestos plant near Black Lake.

Estimated New "Free World"

BRIMSTONE (Long Tons of Sulphur)

Company	Location	New Capacity to Be Added During Year of: 1953	1954	1955	Total New Capacity By End 1955
FROM FRASCH PROCESS					
Freeport Sulphur Co.	Garden Island Bay, La.	500,000	.....	.....	500,000
Freeport Sulphur Co.	Nash Dome, Tex.	.....	70,000	.....	70,000
Mexican Gulf Sulphur Co.	Tehuantepec, Mex.	200,000	.....	.....	200,000
Pan American Sulphur Co.	Tehuantepec, Mex.	.....	300,000	.....	300,000
Freeport Sulphur Co.	Chacahoula, La.	.....	.....	150,000	150,000
Total Frasch Process		700,000	370,000	150,000	1,220,000
FROM OTHER NATIVE DEPOSITS					
Sominar, S.A.	El Sosenado, Argentina	.....	10,000	.....	10,000
Sicilian Mine Operators	Italy	50,000	.....	50,000	100,000
Japanese Mine Operators	Japan	55,000	.....	.....	55,000
Eti Bank (Government)	Keciberlu, Turkey	7,000	.....	.....	7,000
Anaconda Copper Co.	Inyo County, Calif.	40,000	.....	.....	40,000
Continental Sulphur & Phos. Co.	Cody, Wyo.	.....	10,000	.....	10,000
Total Other Native		152,000	20,000	50,000	222,000
FROM SOUR NATURAL GAS					
General Petroleum Corp.	Worland, Wyo.	.....	.....	35,000	35,000
Imperial Sulphur & Acid Co.	Farmington, N. M.	12,000	.....	.....	12,000
Warren Petroleum Corp.	Monument, N. M.	5,200	.....	.....	5,200
Petroleos Mexicanos	Poza Rica, Mex.	6,000	23,000	.....	29,000
Total Sour Natural Gas		23,200	23,000	35,000	81,200
FROM REFINERY GASES					
Yacimientos Petrolifeios Fiscales	Buenos Aires, Argentina	.....	10,000	.....	10,000
Esso Petroleum Co., Ltd.	Fawley, Eng.	12,000	.....	.....	12,000
Shell Oil Co., Ltd.	Shellhaven, Eng.	8,000	.....	.....	8,000
Trinidad Leaseholds, Ltd.	Trinidad	.....	4,000	.....	4,000
Atlantic Refining Co.	Atreko, Tex.	5,300	.....	.....	5,300
Davison Chemical Co.	Baltimore, Md.	8,500	.....	.....	8,500
Davison Chemical Co.	Linden, N. J.	.....	21,000	.....	21,000
Total Refinery Gases		33,800	35,000	.....	68,800
FROM PYRITES					
Noranda Mines, Ltd.	Welland, Ont., Can.	20,000	.....	.....	20,000
FROM SMELTER GASES					
Cia. Real de Austuriana	Bilbao, Spain	10,000	.....	.....	10,000
TOTAL BRIMSTONE		939,000	448,000	235,000	1,622,000

Free World Production of Sulphur in 1952

Frasch Process	5,293,000
Other Native Sulphur	517,500
Other Elemental Sulphur	587,100
From Pyrites	4,509,000
From Gases	1,222,000
From Sulphates	335,000
Total	12,463,600

Sulphur Capacity Grows Steadily

ON THE BASIS OF PRESENT TRENDS, sulphur capacity will have to grow steadily to keep pace with demand. Indications are that net sulphuric acid consumption will grow faster than the national output of goods and services, and sulphuric acid is 75% of the suplhur market.

Low cost Frasch process sulphur from the salt domes of the coast of the Gulf of Mexico dominates the supply picture. In 1952, production from this source was 5,293,000 long tons, or more than 82% of total U. S. production and 42% of the Free World production from all sources.

The Frasch process figure does not reflect full production from three projects completed in 1952; a 50% plant expansion at Texas Gulf Sulphur Co.'s Moss Bluff property; Texas Gulf's new Spindletop plant; and Freeport Sulphur Co.'s

Sulphur Production—1952-55*

OTHER SULPHUR (Long Tons of Sulphur Equivalent)

Company	Location	New Capacity to Be Added During Year of: 1953	1954	1955	Total New Capacity By End 1955
IN PYRITES					
Four-Company Combine	Nairne, Australia	.....	30,000	.....	30,000
Mt. Lyell Mining & Rwy. Co.	Tasmania, Australia	.....	.....	12,000	12,000
S. A. Reunidas F. Materazzo	Sao Paulo, Brazil	.....	6,000	.....	6,000
Cons. Mining & Smelting Co.	Kimberly, B.C., Can.	.....	30,000	.....	30,000
Noranda Mines, Ltd.	Noranda, Quebec, Can.	35,000	.....	.....	35,000
National Power Corp.	Rapee Island, Philippines	.....	.....	10,000	10,000
Rio Tinto and Tharsis	Huelva Province, Spain	.....	.....	735,000	735,000
Board of Trade Project	Rudtjeback, Vb., Sweden	50,000	.....	50,000	100,000
West Rand Consol. Mines, Ltd.	Umbogintwini, S. Africa	18,000	.....	.....	18,000
Bethlehem Steel Co.	Berks County, Pa.	28,000	.....	.....	28,000
Total Pyrites		131,000	66,000	807,000	1,004,000
IN REFINERY GASES					
Consolidated Chemical Industries	Baytown, Tex.	17,500	.....	.....	17,500
Stauffer Chemical Co.	Compton, Calif.	8,700	.....	.....	8,700
Total Refinery Gases		26,200	.....	.....	26,200
IN SMELTER GASES					
Union Miniere-Metalkat	The Katanga, Belgian Congo	.....	5,000	.....	5,000
Sherritt-Gordon Mines, Ltd.	Ft. Saskatchewan, Alta., Can.	.....	15,000	.....	15,000
American Smelting & Refining Co.	Amarillo, Tex.	12,500	.....	.....	12,500
American Zinc Co. of Illinois	Dumas, Tex.	.....	22,000	.....	22,000
Garfield Chem. & Mfg. Co.	Garfield, Utah	25,000	.....	.....	25,000
Total Smelter Gases		37,500	42,000	.....	79,500
IN SULPHATE MINERALS					
Austrian Nitrogen Works	Linz, Austria	5,000	20,000	.....	25,000
I. G. Farbenindustrie	Wulfen, West Germany	.....	.....	30,000	30,000
Gov. Fertilizer Works	Sindri, India	50,000	.....	.....	50,000
Gov. Fertilizer Project	Mai Indus, Pakistan	.....	12,000	.....	12,000
Imperial Chem. Ind., Ltd.	Billingham, Eng.	25,000	.....	.....	25,000
Solway Chemicals, Ltd.	Whitehaven, Eng.	.....	23,000	.....	23,000
United Sulphuric Acid Corp.	Merseyside, Eng.	70,000	.....	.....	70,000
Total Sulphate Minerals		150,000	55,000	30,000	235,000
TOTAL OTHER SULPHUR		344,700	163,000	837,000	1,344,700
TOTAL BRIMSTONE		939,000	448,000	235,000	1,622,000
"FREE WORLD" GRAND TOTAL		1,283,700	611,000	1,072,000	2,966,700

*Estimates based on published information and trade sources.

Bay Ste. Elaine property in Louisiana.

In addition, five new domes are slated to come into production in the next five years (see table above), including for the first time, two in Mexico. These will raise annual capacity from the Frasch process by about 1,220,000 tons to nearly 7.5-million tons.

But how long will the salt domes last? And where will the sulphur come from then?

A glance at world production figures reveals that where Frasch process sulphur isn't available, pyrites are the chief source of supply. There seems to be no reason to doubt that this would hold true for the U. S. where major sulphur companies already hold pyrite reserves. Development would probably require a 25% to 50% higher price for sulphur than the present $25.50 to $26.50 per long ton. And then there is the faint possibility that a rich salt dome deposit could jeopardize existing pyrite enterprises.

While pyrites figure to be the major source in the distant future, sulphur from other sources will be relatively more important too. The problem of air pollution necessitating reclamation of sulphur, and the recent sulphur shortage, has given by-product sulphur a good start, although it is still of minor importance.

Another approach to the sulphur problem is the recovery of sludge acid which even now is receiving a great deal of attention from chemical companies.

Meanwhile, projects underway in the U. S. seem capable of supplying enough Frasch sulphur to meet the bulk of the growing demand.

Phosphate in World-Wide Demand

H. F. DENGLER
International Minerals
& Chemical Corporation
Chicago, Ill.

ALTHOUGH WORLD SHIPMENTS of phosphate rock in 1952 were below those for 1951, it is expected that the increase in demand which rose from 15-million tons in 1946 to an estimated 25-million tons in 1953, will resume at the rate of over 1,000,000 tons a year, so that by 1957-58 annual world shipments should reach 30-million tons.

The U.S.A. alone will participate to the extent of about 45% in the world total. As in the past, the phosphate mining industry in Florida, Tennessee and the Western fields will be prepared to satisfy the domestic demand and in addition have 1.5-million to 2-million tons available for export.

The French mines in Morocco, Algeria and Tunisia, producing and shipping 30% of the world tonnage, should continue their main function of supplying the European market. In Algeria and Tunisia attempts are being made (with some measure of success) by various concentration processes, to improve the grade to more acceptable standards.

The balance of 25% is produced in Russia (details unknown), Egypt, where future production is not expected to exceed the present 400,000 tons per annum, and particularly on the islands of Ocean, Nauru and Christmas, supplying the requirements of Australia and New Zealand. There are a number of other mines of limited importance. All will continue their function as phosphate suppliers for years to come.

With all indications pointing toward increasing demand, search for and the opening of new deposits is being accentuated. Mines in Transjordan are being enlarged and the port of Acaba is being prepared for sizeable export shipments. Also the mining of deposits in the Negev valley of Israel has started—for domestic use and eventually export. Under government direction, a mine is under construction in the Phalaborwa district of South Africa. Studies are being made for the mining of an apatite deposit at Dorowa, Southern Rhodesia. In French West Africa (Senegal) development work is continuing at the alumina and calcium phosphate deposits and an initial 30,000 tons was shipped in 1952 through the port of Dakar. In this hemisphere, considerable deposits have been discoverd in the Recife, Brazil, area. It is expected that mining will begin before long.

Projects Many To Boost Supply

South Africa's Phalaborwa Project. Union Government, through Phosphate Development Corporation formed in August, 1952, plans to produce raw phosphate from persistent, well-defined, apatite-bearing Loolekop orebody at Phalaborwa, northeastern Transvaal, previously studied as to grade and tonnage by Mines Department and Geological Survey. The Corporation has undertaken to provide mining method and equipment required and the necessary concentrator, also water and power supply, as well as to plan housing scheme.

A plant costing £2-million is being built. Operations are scheduled to begin this year. Production at start is to be 56,000 tons of phosphate per year. This will be increased to 112,000 tons, later to 150,000.

Bulk mining followed by flotation, both on a large scale, are indicated by studies, the ore having been tested in laboratory and pilot plant. Concentrates, it is calculated, can be delivered to superphosphate plants on a basis competitive with rock phosphate; can also be used for manufacture of dicalcium phosphate.

For power plant at mine, the Corporation already has two 1,250-hp. turbogenerators with boilers. This station will supply mine compressors, crushing and concentrating section, main pumps at river station, and domestic requirements up to a capacity sufficient to supply 34% of Union's raw phosphate requirements.

In Negev, Israel, beneficiation of recently found phosphate from 50% BPL to 74% is to be undertaken in a new plant of 100,000 to 150,000 tons output capacity for domestic needs. Export is also considered.

Morocco phosphate reserves, reported to yield 4,700,000 tons per year. Production of by-product uranium is being studied.

Elemental Phosphorus from Phosphate Rock. Several new electric furnace installations for making elemental phosphorus are in operation, others are nearing that point. All reflect the big and increasing demand for phosphoric acid and derivatives, also phosphate fertilizers. A survey reveals the following:

Victor Chemical Co. Two 28,000-kw electric furnaces are included in new plant at Silver Bow, Mont., estimated to cost $12-million and produce 14,000 tons per year.

Westvaco Chemical Division, of Food Machinery & Chemical Corporation, as part of its $20-million construction program at Pocatello, Idaho, has completed a 27,000-kw. furnace, capable of producing about 15,000 tons of elemental phosphorus per year. Estimated cost is $6-million.

Monsanto Chemical Co., at Soda Springs, Idaho, has completed a 40,000-kw. electric furnace, costing about $10-million and of a rated capacity of 25,000 tons of elemental phosphorus per year.

American Agricultural Chemical Co. is expanding its production facilities, to cost $1,875-million, including installation of a new 5000-kw. electric furnace, also addition of a belt concentration section to its South Pierce rock plant.

Shea Chemical Co. has provided, at $2.6-million cost, a 25,000-kw. furnace for making elemental phosphorus and a dicalcium phosphate plant.

Other projects for expanding production and improving facilities include the following:

International Minerals & Chemical Corp. has two certificates of necessity permitting quick amortization, certified Sept. 25, 1952. One for $7.7-million covers the opening and equipping of a new phosphate mine at the company's New Phosphoria properties. The other, for $1.2-million, is to provide a new Bucyrus-Erie 1250-B dragline to increase mining capacity.

The company also is working in a pilot plant with its new electric separation process.

Davison Chemical Corporation has been spending $12.4-million on construction of a triple superphosphate plant, of 200 000 tons annual capacity, which it expects to complete in 1953.

Swift & Co. is spending $1.5-million to increase its capacity by 50% for making triple superphosphate. The project will be complete this year. Facilities for housing control and research laboratories, also general offices, are being provided.

Coronet Phosphate Co. has spent $1-million for new drying, grinding and shipping facilities, which should raise its capacity 500 000 tons per year. Obtained a certificate of necessity for $850,000 Sept. 17, 1952.

Virginia-Carolina Chemical Corporation is spending $2-million on expanding and improving its centralized facilities for wet storage, drying, grinding and shipping. Drying and grinding capacity is being increased. It is also building a $5-million triple superphosphate plant.

Armour Fertilizer Works obtained a certificate of necessity for $5.62-million Oct. 15, 1952 to develop and equip a new mine on site of abandoned Morris mine. Capacity output will be ¾-million tons per year.

Ruhm Phosphate & Chemical Corp. has modernized Hoover & Mason drying and grinding plant, moved it to Columbia, Tenn. Cost $600,000.

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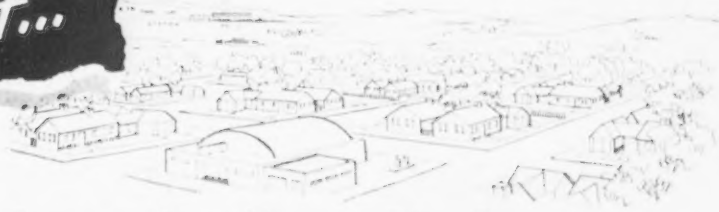

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IRON ORE

(*Continued from page 109*)

At the Malmberget mine, similarly owned, the ore will have to be hoisted as mining will start below railroad level. Production will be almost doubled. This project was started in 1948 and was extended to meet a greater demand in 1951. Completion is anticipated in 1955. A new wet-magnetic concentrating plant will be completed in 1957. Present annual production rate at Malmberget is 3.5-million metric tons (2.7 in 1948). On completion, it will be 5.0-million metric tons.

Operating features at Malmberget will be: Increasing use of longhole blasting; transportation in 25-ton cars; crushing underground to minus-4-in.; Conveyor transport of crushed ore to surface on three to four single-lift rubber-covered steel-belt conveyors, length 1700 ft., lift 490 ft. in the first stage. Magnetic fines (—20 mesh) will be concentrated in an 800,000-ton mill. A pelletizing plant is being built to produce pellets from a magnetic concentrate containing 71.5% iron and under 0.010% phosphorus.

The Luossavaara-Kiirunavaara Co. will make a capital investment in Kiirunavaara and Malmberget, also including necessary modernizing and enlargement of the Narvik harbor in Norway, which amounts to about $100-million.

Sponge Iron Finding Favor

Output of the iron and steel industry in Sweden is to be raised to over 2-million tons per year by 1955. Five companies are planning sponge-iron plants, having found sponge iron a satisfactory raw material. While the country has up to 50-million tons of good low-phosphorus ore and many times this amout of high-phosphorus ore, it finds it difficult to get adequate coal and coke and has been using oil and electric power more and more.

Norway's Sydvaranger Co., a source of high-grade concentrates, for European steel production before its plants were destroyed in 1944, was restored to production of concentrates running 66% Fe in 1952, at a total cost of about $18-million. Production of concentrates this year will be about 850,000 tons, and of crude ore from Björnevann mine about 1.8-million. Diamond drilling after the war showed 30-million tons of proven ore and a like amount of possible ore. The company's present ore source is its Björnevann mine, near Kirkenes.

Exploration drilling in Dunderland area has shown a tonnage of about 200-million. So far no capital investment has been made. The ore in this area is mainly hematite, which makes concentration less simple than at Kirkenes, where the ore mineral is magnetite. Tests have been made and are to be continued on a larger scale in a small pilot plant at Trondheim, in connection with the ore-dressing laboratory which is being built and equipped at the Institute of Technology of Norway there. It is impossible to say when the project will be started or completed. In general, it will involve underground mining and provision of crushing and beneficiation plants.

If the development is undertaken, the concentrate will be used to supply the State's steel plant now being built at Mo i Rana, which is expected to go into operation about the end of 1954. Even if this happens, it will leave the greater part of Sydvaranger's production available for export.

Finland's Otanmaki mine contains 50-million tons of ore running 35% iron and 12-15% TiO_2. Mill capacity, when built, will be 500,000 tons of ore per year, producing about 175,000 tons of iron concentrates, 75,000-100,000 tons of ilmenite concentrates. Investment will be about $7-million.

France. Simultaneously with the steel plant modernization under the Monnet plan in France, great advances are being made in iron ore preparation, almost non-existent before the war. Recent tests have shown that highly heterogeneous siliceous ores of Lorraine, formerly hard to treat, are quite amenable to beneficiation. See also World Mine Expansion Section, starting page 182.

In Yugoslavia an economic development program based on exploitation of mineral resources is underway, with technical and financial assistance from the U. S. and West European countries. Capital investment in 1952 involved completion during the year of about 100 mines, industrial plants and power stations. When new iron and steel plants now building are finished, Yugoslavia will produce annually about 2.5-million metric tons of iron ore. Output of ore from two iron mines in Bosnia was expected to reach 1.5-million metric tons last year. Reserves of Bosnia-Herzegovina are 130-million tons.

Rich iron ore deposits in Sardinia, totaling about 10-million tons, are the principal basis of a new iron and steel industry planned by Italy.

Austria's largest iron mine, the Erzberg, received from MSA approval of a loan of $500,000 in supplemental financing of equipment.

Iron ore deposits' potential in French West Africa will be investigated. Development of new sources will be years in the future.

Liberian Bonanza

Bomi Hills' reserve of iron ore, in Liberia, estimated at 35-million tons suitable for the open-hearth furnace, has been made available to Republic Steel Corporation and the steel industry by a deal in which the participants were Liberia Mining Co. and its president, L. K. Christie, the Government of Liberia, and Republic. The ore averages over 68% iron and is low in phosphorus and sulphur. At a proposed annual production rate of 1¼-million tons, expected to be realized in 1953, the estimated tonnage should be good for three decades. Republic is said to have acquired this source, to the extent that it shares in it, at an investment cost that is about half of that of the average U. S. iron ore enterprise.

Table of Projects

(*Continued from page 100*)

Woodward Iron Co.'s $18-million expansion program included construction of a Heavy Media plant at its Pyne mine which is now complete. The difficult task of drifting through the Shannon fault, likewise completed, was also part of this program.

Tennessee Coal, Iron and Railroad Division (U. S. Steel) is now loading all ore with Joy loaders. This increase in mechanization, coupled with a scheme for insuring proper maintenace, makes it possible to load 100,000 tons of ore in 160 machine shifts, or 625 tons per machine shift. An electrically operated Caterpillar D-6 is also being used to move muck up to the loader to keep it working at maximum efficiency. After the round is shot, the 'dozer piles up the muck and clears roadway for loader.

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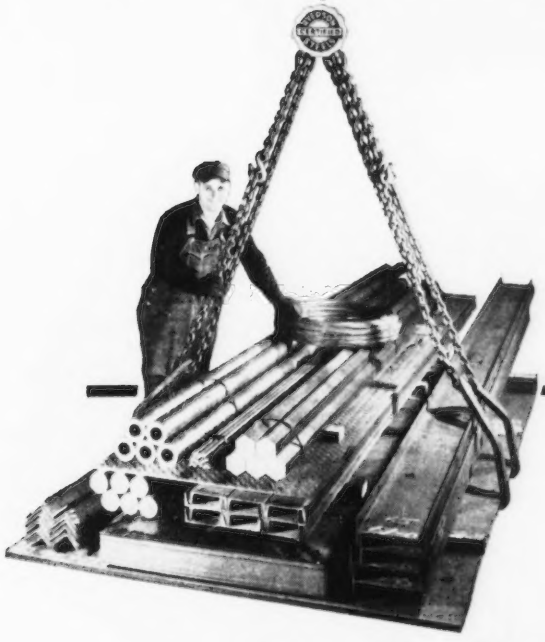

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PERSONAL NEWS

The Granby Consolidated Mining, Smelting & Power Co., Ltd. announces the following changes in staff positions at Copper Mountain: **J. A. C. Ross**, formerly mine superintendent, has been appointed general superintendent in charge of all operations at Copper Mountain. He is succeeded by **D. W. Pringle**, who was formerly his assistant. **J. J. Crowhurst**, formerly mine manager, becomes assistant mine superintendent.

George Crerar, mineral dressing and metallurgical engineer has a new permanent address at White Thorn Ranch, Briceland, Calif. He is no longer serving in a consulting capacity to Telluride Mines, Inc.

Ernest N. Patty and **Merle Tuve** were awarded honorary Doctor's degrees at the 1952 commencement of the University of Alaska. "Dean" Patty was one of the six original faculty members when the college was started in 1922. He helped organize the School of Mines and was its first dean in 1925; he has continued to be active in University affairs since his resignation from the faculty in 1935. Dr. Tuve, who was active in sponsoring the Geophysical Institute in Alaska, is an internationally known physicist.

George H. Deike, Jr. has been elected vice president of Mine Safety Appliances Co.

Glen B. Lerch, president, and **Walter S. Nelson**, special chemist, of Lerch Brothers, Inc., have returned from a trip to the Quebec-Labrador ore fields of the Iron Ore Company of Canada. Lerch Brothers has recently been placed in charge of all of the chemical laboratory and ore shipment sampling operations for the Iron Ore Company in Quebec and Labrador.

Richard V. Colligan, mining geologist, has been placed in charge of Cuban activities of Freeport Sulphur Co. and its subsidiary, Nicaro Nickel Co. Mr. Colligan's work will include supervision of the work at Moa Bay in Oriente Province, where the Nicaro company recently discovered what is believed to be one of the most important proven sources of nickel in the free world.

E. McL. Tittmann, general manager of the Western department of American Smelting & Refining Co., and **W. G. Rouillard**, manager of the Garfield plant, recently visited the New York office of the company. **B. J. DiSanto**, chief engineer of the primary U. S. lead and copper smelters and refineries visited the Peruvian properties of the company during May.

After 30 years as head of Sprague & Henwood, Inc., drilling contractors and manufacturers, Scranton, Pa., **James A. Ross** has been made chairman of the board. **Adrian E. Ross** has been named president, and **William J. Schank** has been appointed senior vice president and general manager.

CERRO DE PASCO CORP. announces the election of CHARLES B. HARDING as a director. Mr. Harding, senior partner of Smith, Barney & Co., investment bankers, was Chairman of the Board of Governors of the N. Y. Stock Exchange in 1940 and 1941, and is a member of the Industries Advisory Committee of the Advertising Council and the Finance Committee of the Committee for Economic Development.

H. D. Clark and **Charles W. Yetter** have organized Engineers Associates, Inc. in Grand Junction, Colo., to render consulting engineering and management services, with particular reference to the uranium industry of the Colorado plateau.

Percy E. Landolt, executive vice president of the Lithium Corp. of America, Inc. has been elected president of the Columbia University Engineering School Alumni Association for the 1953-54 academic year. One of Columbia's first chemical engineers, Mr. Landolt received his degree in 1912 and has been active for several years in alumni affairs.

WALTER A. STERLING who was recently elected president and a director of the Cleveland-Cliffs Iron Co. after many years of service with that organization.

Robert Fry has joined the staff of Norcanda Engineering Co., Ltd., Toronto, as general superintendent where he will handle contracts for quarrying, shaft sinking, and underground development. He was formerly superintendent of the Donchester mine of Beattie-Duquesne Mines Ltd.

Isbell Construction Co.'s Leviathan open-pit mining project near Markleville has a new superintendent—**Ellis Fielding**. He replaces **Frank Zielinski**, who is taking a leave of absence for medical treatment. Fielding is former superintendent of Isbell mining activities at Kennecott Copper's Chino mine in New Mexico. Production of sulphur ore from the Leviathan mine will begin soon.

S. Power Warren, of Denver, Colo., will spend the next several months in New England, near Hartford, Conn., supervising the design and installation of a cyanide plant to recover gold from factory wastes. He has recently completed nine months of experimental work at the Colorado School of Mines Research Foundation on the concentration of carnotite ores.

Harold L. Childress, general manager of the Buffalo and Mark Twain mining companies succeeds **O. W. Bilharz** as president of the Tri-State Zinc and Lead Ore Producers Association. Other officers elected are: **Elmer Isern**, first vice president; **H. G. Weidman**, second vice president; and **Ward Ball**, treasurer.

James W. Odell, formerly with American Zinc, Lead & smelting Co. is now with the St. Joseph Lead Co. at its Leadwood division, Bonne Terre, Mo., as geologist.

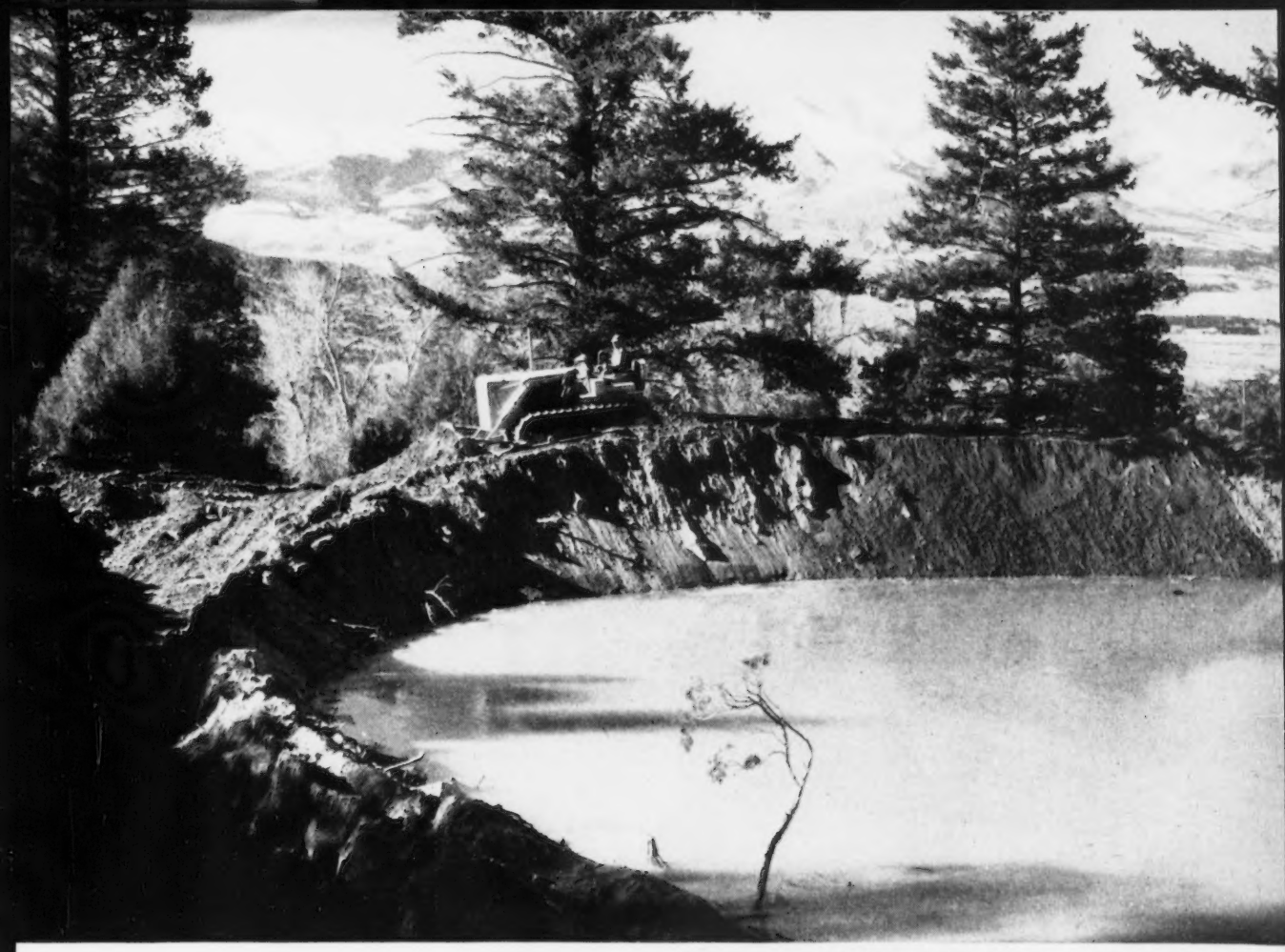
R. F. Robinson has been named acting district supervisor for U. S. Geologic Survey in the Arizona-New Mexico area, where he is working on DMEA projects. He was formerly chief geologist for Sunshine Mining Co. at Kellogg, Idaho.

Raymond Brooks of the Rhodesia Copper Ventures, Ltd., is on leave until November 1953, and is spending part of this time in Tucson, Ariz.

Ralph K. Gottshall was recently elected president of Atlas Powder Co. of Wilmington, Del., to succeed **Isaac Fogg**, who becomes chairman of the board and remains chairman of the finance committee. Mr. Gottshall joined the company in 1927 after graduation from Lafayette College.

Co-manager of the Crystal Fluor-

(Continued on page 322)



High in mountains near Poncha Springs, Colo., this Caterpillar D6 Tractor with No. 6A Bulldozer, owned by Reynolds Mining Corp., constructs a new fluorspar settling pond. Fluorspar will be used in Reynolds' Alexander, Ark., aluminum plant. Across valley are beautiful Collegiate Peaks, near famed Leadville mining district.

ON TOP OF THE WORLD...ON TOP OF THE JOB

Even in tough going like this, the Cat* D6 Tractor stays on top of the job. At about 8,000 feet altitude, it 'dozes rocks and dirt—much of the latter frozen—in temperatures that range from summer heat to far below zero.

High altitude is a difficult test of an engine, but the rugged Caterpillar-built Diesel Tractor delivers plenty of power to do rough jobs fast. It's built to keep working for you for many thousands of hours without down time or tinkering, thanks to sturdy construction, specially hardened cylinder liners, long-wearing aluminum-alloy bearings, and efficient oil and air filtration.

The versatile No. 6A angling blade can drift material over banks as well as do straight 'dozing. Scientific curving of the moldboard permits big, rolling, fast-moving loads. This means you get more work per hour—*more work per dollar*—from a Cat-built Bulldozer.

Many jobs around mines are equipment-busters. That's why you need the extra, built-in *toughness* of Caterpillar machines. Your Caterpillar Dealer will gladly show you, on the job, the tractor and matched bulldozer that will do most for you at lowest cost. Your dealer backs his products with fast, skilled service and genuine factory parts.

Caterpillar Tractor Co., Peoria, Illinois.

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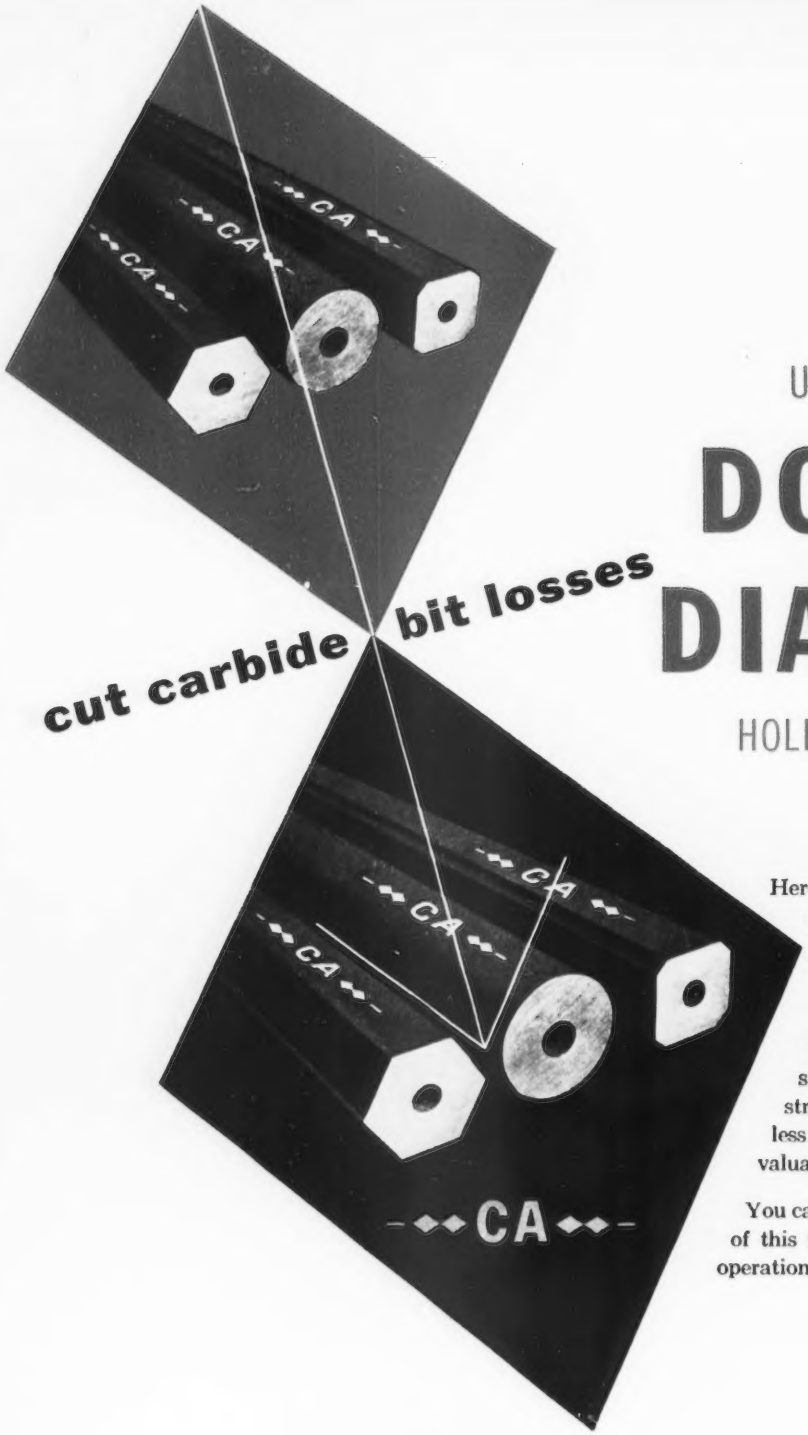

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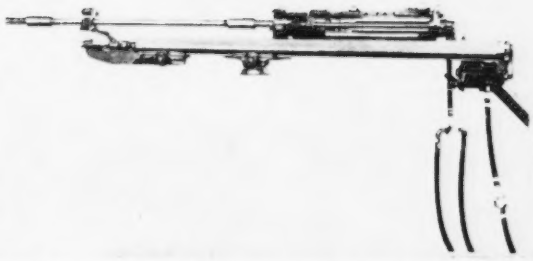
E & M J

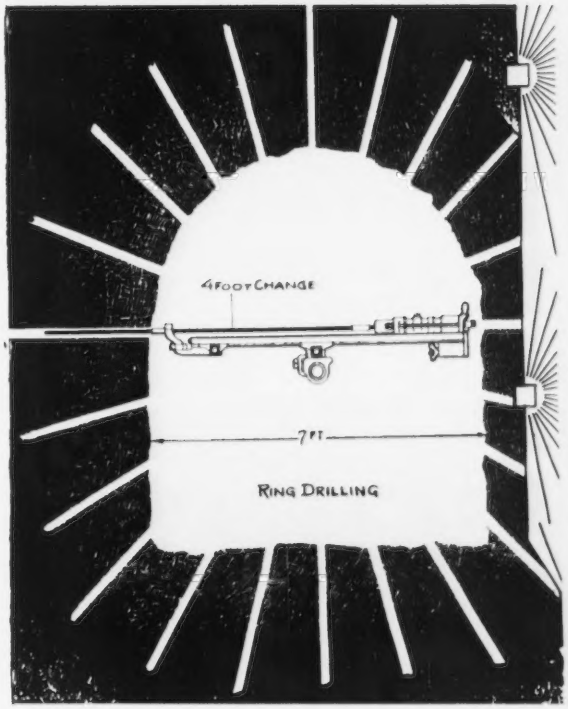
NEW PRODUCTS DIGEST

For further information on these products, circle item numbers on card—insert and mail.



PERCUSSION DRILL is reported to be the first designed especially for deep hole drilling.

Percussion Drill is Designed for Deep Hole Drilling



TYPICAL RING DRILLING pattern shows how new drill permits 4-ft. change in 7-ft. drift.

REPORTEDLY THE FIRST percussion drill designed for the special problems of deep hole drilling, a new drill, known as Model SFH99, announced by Gardner-Denver Co., Quincy, Ill., permits a 4-ft. steel change in a 7-ft. drift. The new machine facilitates the practice of horizontal or vertical ring drilling of long blast holes from a single set-up using a percussion drill and sectional rods.

Among the important features of the drill is the arrangement whereby the shank rod is locked in the chuck to prevent loss of the rod string in down holes. An extra-heavy centralizer supports the rod string during changes, and thus simplifies up-hole drilling. Model SFH99 is equipped for reverse rotation which, together with the locked-in shank rod, enables the operator to use power from the drill for uncoupling rods with only one wrench.

The machine is equipped with the same Gardner-Denver ring seal shank which, according to reports, has been used successfully with sectional rods for several years. The ring seal shank delivers either air or water into the rod string at high pressure.

For additional details, circle No. 1 on the postage-free reply card opposite p. 174, and mail soon.

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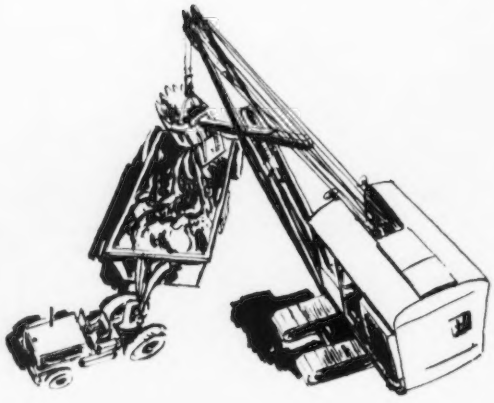
We've claimed that your Caterpillar Dealer backs them up with prompt, on-the-spot service.

We've claimed they will last longer—and do more work with less down time than any other unit.



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DIESEL ENGINES AND ELECTRIC SETS

For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their numbers on card below and mail.

POWER CABLES. Illustrations, dimensions, specifications of numerous types of power cables are available in the 28-page catalog from Collyer Insulated Wire Co., Pawtucket, R. I. (41)

SAND PUMP. How the Denver centrifugal vertical sand pump handles frothy pulps without dilution or continuous attention is described in Denver Equipment Co. Bulletin P10-B4. Pumps are available in six sizes from ¾ to 4 in. (42)

HILOADER. A four-page folder describes a machine that is real handy for loading from stockpiles into railroad cars or similar applications. Athey Products Corp., Chicago, Ill. (43)

V-BELTS. A fractional horsepower V-belt catalogue for use in servicing light duty applications, lists belts according to the new industry-standard numbering system. Various type machines are listed together alphabetically, by company or trade names, for convenience in determining the proper belt. Raybestos- Manhattan, Inc., Passaic, N. J. (44)

DYNAMOMETER. The W. C. Dillon & Co., Inc., of Van Nuys, Calif. has a four-page bulletin to tell you why you should use their dynamometer for accurate and inexpensive production testing. (45)

PUMPS. Single-stage, double suction centrifugal pumps (Type S) in 66 standard sizes are described in a newly revised Bulletin 08B6146B issued by Allis-Chalmers Mfg. Co., Milwaukee, Wisc. (46)

ROLLER BEARINGS. This 30-page catalogue, No. 200C, contains a new spherical roller bearing width tolerance chart; complete thread, locknut, and lockwasher data; a revised interchangeability chart; additional special bearing pictures; and is designed for easy reference on practically anything you want to know about self-aligning spherical roller bearings. Torrington Co., South Bend, Indiana. (47)

DIATOMITE. A 28-page brochure, "Celite—The Story of Diatomite", has just been published by Johns-Manville, New York, N. Y. Designed for both laymen and technical men, it uses both photographs and drawings, as well as the text, to trace the story of Diatomite. (48)

CONSTRUCTION. Construction Aggregates Corp., hydraulic land fill specialists, has released a brochure entitled, "Men, Methods, and Machinery," which tells by means of case histories what the company is qualified to do in the solution of perplexing construction problems. It includes some ingenious uses of equipment. Construction Aggregates Corp., Chicago, Ill. (49)

TEMPERATURE CONTROLS. A general description of all electric temperature controls with a separate section for pneumatic and valve type controls is contained in condensed Catalogue G-18 of the Burlington Instrument Co., South Orange, N. J. (50)

BAGS. A colorful, eight-page booklet is offered by the Elwell-Parker Electric Co., Cleveland, Ohio, entitled "The Logistics of Bags." The handling cycle is described from receiving, through processing and shipping. Photos show various methods of handling by fork and platform truck, plus the use of many specialized attachments to increase versatility of handling. (51)

HOISTS. Full information on Sauerman Hoists for operating power scraper excavators and storage machines, slackline cableway excavators and tautline cableways. Sauerman Bros., Inc., Chicago, Ill. (52)

PIGGYBACKS. Piggybacks are continuous conveyors, designed for loading of coal. Many of the illustrations shown are applicable in non-metallic mining. This catalogue may give you some good ideas for ore handling. Long Super Mine Car Co., Inc., Oak Hill, W. Va. (53)

TAMPING PLUGS. A means of cutting stemming time to seconds through the use of Quick-Seal tamping plugs is described in a bulletin published by National Mine Service Co., Beckley, W. Va. According to the brochure, these plugs will save powder, provide more effective breakage and greatly reduce stemming time in open pits, quarries, tunnels, underground metal and non-metallic mining operations. (54)

ROLLER CHAIN. A riveted chain that is as easy to couple or uncouple as cottered chain is described in de-

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to obtain further information on products and bulletins mentioned in the New Products Digest. Circle item numbers, tear out and mail.

Not good after September 1, 1953, if mailed in the U.S. or Canada.

Engineering and Mining Journal—July, 1953

NOT GOOD AFTER SEPTEMBER 1, 1953—if mailed in U. S. or Canada.

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

1	8	15	31	38	45	52	59	66	73	80
2	9	16	32	39	46	53	60	67	74	81
3	10	26	33	40	47	54	61	68	75	82
4	11	27	34	41	48	55	62	69	76	83
5	12	28	35	42	49	56	63	70	77	84
6	13	29	36	43	50	57	64	71	78	85
7	14	30	37	44	51	58	65	72	79	86

My Name ..... Position .....

Company .....

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tail in a new bulletin, No. 52-2. now being distributed by Baldwin-Duckworth, division of Chain Belt Co., Springfield, Mass. (55)

ELECTRONIC CONTROLS. Information on operation and applications of on-off, two-position, three-position and "Pulse-type" time-proportioned controllers is included in catalog 1053 as well as data on primary measuring elements, dimensions, ordering information and scale selection tables. Minneapolis-Honeywell Regulator Co., Philadelphia, Pa. (56)

POCKET SIZE CALCULATOR. This midget weighs 8 oz., has a diameter of about 2 in. and a length of 3⅜ in. Operation is easy to learn, maintenance is claimed to be simple. U. S. agent for this German made calculator is Curta Calculator Co., Chicago, Ill. (57)

PHOTOELECTRIC RECORDER. A two-color bulletin on photoelectric applications is available from the General Electric Co., Schenectady, N. Y. The fully illustrated 12-page publication, GEA-5536, describes applications of the recorder with seismology, psychology, textile, metals, fatigue and research testing equipment, as an aid in the quick detection of pipeline corrosion, and in development and machinability testing, medical research, light intensity study, and paper-machine-speed measuring. (58)

DIESEL-ELECTRIC SETS. Detailed description of five Caterpillar diesel-electric sets is contained in a 20-page booklet issued by Caterpillar Tractor Co., Peoria, Ill. Fifty illustrations help describe key points and advantages of these sets. Form 30507. (59)

TRACK SUPPLIES. Savings in time and money through single-source buying of track materials and supplies, are the subject of "Switch Materials", a 44-page catalog issued by L. B. Foster Co., Pittsburgh, Pa. Contains general information to help you in ordering and installation of frogs, switches and stands, along with descriptions and specifications of these and other items. (60)

SCRAPER. Details of the new "lever action" 15.5-yd. scraper having vertical mounted jacks actuating levers which independently control bowl, apron and ejector, is presented in a 16-page folder offered by Euclid Road Machinery Co., Cleveland, Ohio. (61)

SHUTTLE CARS. Catalog 532 from Goodman Mfg. Co., Chicago, Ill., describes and discusses construction features and their application to six models of the company's cable reel shuttle cars. (62)

FERTILIZER PLANTS. In a 6-page folder, Dorr Co., Stamford, Conn., outlines the services they are prepared to render in helping you design your fertilizer plant, and shows why they are qualified to offer these services. (63)

MAGNETS. Two-color, 8-page bulletin is profusely illustrated with cut-away sections, photos, and application shots of lifting, separation, and road sweeping magnets. Gives weights and lifting capacities for all standard bolted, welded and basket type magnets. Ohio Electric Mfg. Co., Cleveland, Ohio. (64)

ROLL CRUSHES. Bulletin No. 282 discusses Telsmith roll crushers in three sizes; 24 x 16 in., 30 x 18 in., and 40 x 22 in. Recommendations on their use are also included. Smith Engineering Works, Milwaukee, Wisc. (65)

FLEXIBLE COUPLINGS. Tables of capacities, specifications and ordering information for flexible couplings in 22 standard bore sizes from ¾-in. to 6½ in., for applications on Cone-Drive worm shafts, Cone-Drive gear shafts, and electric motor shafts, are contained in a four-page bulletin from the Michigan Tool Co., Detroit, Mich. (66)

POLYPHASE INDUCTION MOTORS. Bulletin 37-200 describes large wound-rotor and squirrel-cage polyphase induction motors. Twenty-four photographs on six pages show many special designs of high horsepower motors. Electric Products Co., Cleveland, Ohio. (67)

VACUUM PROCESSING SYSTEMS. Rotary and rotating vacuum driers, vacuum shelf dryers, freeze driers, equipment, impregnators, extraction and solvent recovery apparatus, and vacuum pumps are pictured and described in the 12-page catalog called "Complete Vacuum Processing Systems." New sections deal with vacuum metallizing and vacuum furnaces. Catalog No. 730 is offered by F. J. Stokes Machine Co., Philadelphia, Pa. (68)

GRINDING MILLS. With cut-away pictures, installation photos, and just plain words, circular AH-440 from Hardinge Co. Inc., tells you about their line of conical, rod, cylindrical, tube, batch, and Tricone mills. (69)

TUBE MILLS. A complete line of tube mills for grinding and pulverizing is described in a 12-page catalog issued by Hardinge Co. Inc., York, Pa. (70)

JAW CRUSHERS. How they are made, what size they come in, how they operate and why you should use Denver are all covered in this eight-page bulletin on jaw crushers made by Denver Equipment Co., Denver, Colo. (71)

SHOVEL - DRAGLINES. Bucyrus Erie has done a dandy job in 3 catalogs illustrating their 4½-, 6-, and 8-cu.-yd. shovel-draglines. If you're in

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the business of moving lots of material, you will certainly want this for your file. Get them all by circling number 72. (72)

BLASTING. Hercules Powder Co., Wilmington, Del., has put out a comprehensive booklet on their line of explosives and blasting supplies. There is also a booklet which discusses Hercomite and Gelamite explosives, specifically. (73)

STEEL PANEL BUILDINGS. How to cut mining costs, improve safety and increase efficiency with patented steel panel buildings is what you will find out by reading six-page bulletin issued by Armco Drainage & Metal Products, Inc. Drawings and photographs of various mining applications help illustrate the advantages of this low cost construction. (74)

BATTERIES. Construction of lead acid storage batteries, highlighting advantages, and giving engineering specifications which should enable the battery user to determine the best unit for his particular application, are discussed in brochure, ML-566 of C & D Batteries, Inc., Conshohocken, Pa. They are particularly interested in telling you about their Slyver-Clad battery. (75)

PUMPS. Full color bulletin describes Holloshaft Gear Drive to operate vertical turbine pumps where electricity is not available. Some really good illustration work shows up features of this unit. U. S. Electrical Motors, Inc., Los Angeles, Calif. (76)

MINING TOOLS. Drill bits, augers, rotary roof bits, pinning rods and a variety of other mining equipment are shown and talked about in an interesting catalog (M-7) from Kennametal Inc., Bedford, Pa. (77)

ULTRASONIC INSPECTION. Applications of ultrasonic testing with the Reflectoscope are illustrated in a release from Sperry Products, Inc., Danbury, Conn. Maybe you'll find something here that will help you in checking your own machinery and keeping it operating. (78)

GEAR DRIVES. A 36-page book, number 2519, offers detailed information about single, double, and triple reduction enclosed herringbone gear drives. Offered by Link-Belt Co., Chicago, Ill., this book has a number of tables which should be helpful to the engineer. (79)

BELTS. High-capacity Texrope belts for tough jobs are described in a bulletin released by Allis-Chalmers Manufacturing Co., Milwaukee, Wis. (80)

MILLING EQUIPMENT. Denver Equipment Co., Denver, Colo, gives you a clear view of their entire line of ore dressing equipment plus some notes on their special services, in an eight-page folder. (81)

Equipment Shorts

PHOTOMETER. A sensitive and versatile instrument for detecting minute concentrations of gases is the latest tool developed by the laboratories of E. I. duPont de Nemours & Co., Wilmington, Del. The ultraviolet photometer operates by measuring the decrease in intensity of a beam of ultraviolet light when the contaminated atmosphere is allowed to pass through a transparent vessel mounted in the beam. (36)

BATTERIES. Twenty percent more capacity in the same space is the sensational claim that Electric Storage Battery Co., Philadelphia, Pa., makes for its new line of T-H Exide Ironclad batteries. The new battery uses the slotted tube positive plate, and grids contain corrosion-resistant Silvium. (37)

PUMPS. Three new models of centrifugal pumps, VBH, VD, and VE, have been added to the line of Pioneer Pump Division, Detroit Harvester Co., Detroit, Mich. Pumps are suitable for all kinds of liquids not too viscous or too corrosive. Each model is available in sizes from 1/20 to 5 hp. Larger sizes are rated at up to 148 gpm. at free flow. (38)

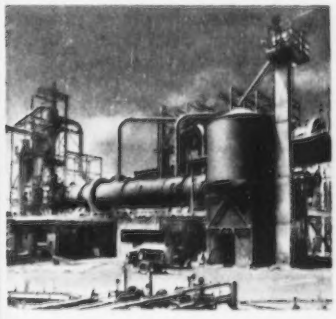
ALL-WOOD TRUCK BODIES. Apparently wood has returned to military vehicle construction. At least, the Army demonstrated three all-wood truck bodies to the Ordnance Corps in a ceremony at The Pentagon recently. Among innovations in construction are new waterproof glues, new treating materials and processes, use of modern water repellents, and modern concepts in designing laminated assemblies. Timber Engineering Co., Washington, D. C. (39)

LUBRICATION. Lubrication of conveyor trolley wheels can be made automatic, certain, and safe with a lubricator announced by Stewart-Warner Corp., Chicago, Ill. The new Alemite lubricator delivers a preset, constant shot of either oil or lubricant to each trolley wheel on each side of the conveyor system simply by the flick of a switch. When every wheel in the system has been serviced, the lubricator may be switched off ready to go into operation again whenever conditions require. (40)

what's NEW in Engineering

The shortage of engineers in all fields, according to three leading universities, will continue until 1955 or 1956. Then, a more balanced supply and demand picture should emerge—thanks to heavy registration of engineering students in the past two years. Meanwhile, one major university reports that in June they had over 1,000 jobs on file—open to 260 graduates.

Microscopic sea plants, called diatomaceae, are getting a lot of attention at Lompoc, California. Deposited geologic ages ago on the floor of what was then an island sea, their fossils are highly valued in many industries for filtering, refining, and other processes. To utilize



the huge deposits at Lompoc, Kaiser Engineers recently designed and built one of the largest and most modern Dicalite plants in the nation for Great Lakes Carbon Corp. We'll send you a reprint of an article in *Industrial and Engineering Chemistry* which tells the story of Lompoc's diatoms.

Chi-Teh Wang, N. Y. U. aeronautical engineering professor, has written a book on a new approach to elasticity. To be published by McGraw-Hill in August, *Applied Elasticity* presents useful analytical and numerical methods of applying fundamental elasticity theories.

Did you know that Kaiser Engineers is noted for widely diversified engineering talents? Departments include civil, structural, electrical, mechanical, architectural, process and production, mining and geology, metallurgical and chemical—all prepared to work closely together on any project. When you have a problem in engineering, call or write Kaiser Engineers Division of Henry J. Kaiser Company, Kaiser Building, Oakland 12, Calif.

WASHINGTON IMPACT

Morton A. Reichek, McGraw-Hill Washington News Bureau

Minerals Program In Doubt—Freeze On Long-Term Buying Holds—Bill To Form Federal Minerals Corp. Seems Blocked

MINING MEN ARE BEGINNING to wonder how White House plans to reduce Federal spending and to revamp mobilization planning will affect the government's mineral expansion program and future demand for metals.

The Eisenhower administration has called for a $8.5-billion cut in the budget submitted by ex-President Truman. This would mean a $5-billion drop in actual spending for fiscal 1954. Major budget cut will come in the Defense department, where there will be a $4.5-billion reduction. Many Republican leaders in Congress want to trim Federal spending even more to make tax reduction possible before next year's elections.

In mobilization planning, the Pentagon has abandoned the concept of a "target date." This was originally late 1954 and more recently mid-1955. It represented the time when the U. S. would or should be ready for total war. It was based on: 1, the speed at which the U. S. can be expected to rearm; and 2, the apparent intentions of possible aggressors.

Now, the Pentagon, new Defense Secretary Charles E. Wilson in particular, views the target date as arbitrary and fictitious. As the military planners see it, if the U. S. did reach total readiness for war by a specific date, and then no war seemed likely to break out, billions of dollars would have been wasted.

They now favor what's called a "steady level of readiness." This would involve continuing review of all defense programs, with major attention to design and development work. Wilson contends this can be done on a relatively moderate budget, which accounts for his persistence in cutting military spending.

Many responsible officials concerned with metals supply are unhappy about abandonment of mobilization target dates. They declare that planning for expansion and stockpiling is made more difficult without a fixed date to shoot at.

Up to now, stockpile objectives have been calculated by subtracting potential supply of a specific material from estimated five-year requirements. The latter hinged on military end-product needs. The deficiency between the two became the so-called "expansion goal for mining."

An interpretation of administration policies on Federal spending and mobilization planning indicates that the freeze on long-term government purchase commitments for metals and minerals will continue indefinitely. But the freeze will be thawed occasionally for such still-critical materials as nickel, cobalt, mica, titanium, beryl, columbium, and tantalum.

There is now serious talk about cutting back on outstanding contracts for lead, zinc, copper, tungsten, chrome, and manganese. Although the long-term purchase contracts contain no provision for cutbacks, some government officials believe settlements could be negotiated to halt production.

Producers could also resort to litigation in the U. S. Court of Claims. They would be discouraged, however, by the long-drawn-out legal battle of Homestake Mining Co. and 15 other gold mine operators, who have sued for damages incurred under the War Production Board's gold-mine closing order during World War II ("Washington Impact," *E&MJ*, April 1953).

But the case for continuation and possible increase of the stockpile and government-stimulated mining expansion programs is by no means lost. There are some highly-placed government officials who are arguing that "the best protection for the U. S. in an era of possible international tension is high-level stockpiling of strategic materials." They contend that it is false economy not to have an adequate stockpile.

Their favorite argument is that the government failed to buy 18¢ copper in 1949, then extended itself three years later to buy 36½¢ copper. By stockpiling copper sufficiently in 1949, they state, the elaborate Controlled Materials Plan, for copper at least, would have been unnecessary when the Korean conflict started.

How much metal stockpiling or expansion the government will conduct in the future depends very much on who becomes the assistant director for materials in the reorganized office of Defense Mobilization. To a great degree, he will be in a spot to pull the strings. As this column went to press, Arthur S. Flemming, ODM's director, was still seeking a "distinguished industry executive" to take the job.

Several, including a petroleum man, have already declined the offer. It is understood that ODM is avoiding the selection of a metal mining man for fear that he would not be "objective."

ODM Reorganization

The ODM reorganization became effective last month, giving the agency permanent and statutory status. It assumed the planning functions of the former National Security Resources Board and the stockpile responsibility of the Munitions Board. ODM also retains its regular job as top-level mobilization bureau for operations and planning.

ODM now consists of these offices: materials, conducts the stockpile and expansion programs; production and requirements, plans full mobilization capacity and needs, coordinates output and expansion for strategic end-products, expedites defense production, and directs the production controls system; financial policy, operates incentives for expansion of defense facilities; non-military defense, plans for plant dispersion and post-attack rehabilitation; manpower; economic stabilization.

The materials office will have specific divisions for non-ferrous metals; light metals; non-metallic minerals; iron, steel, and ferro alloys; chemicals and rubber; agricultural and forest products. Coordinating them will be branches for expansion and stockpile operations. The office will be staffed by about 20 commodity specialists, who will act as "deans" of the numerous commodity experts in other government agencies.

To the satisfaction of many critics, the ODM reorganization brings under one roof for the first time the related responsibilities for stockpiling, expansion, materials controls, conservation, and allocations. But it also removes the Interior Department's authority to participate in stockpile policy making.

Lyon Appointment Out

The President's nomination of Tom Lyon as director of the Bureau of Mines fell flat June 24, when Mr. Lyon withdrew his name. Senate hearings brought out that Lyon did not believe in the Coal Mine Safety Act, which, as Bureau director, he'd have to administer, and that he receives a revocable pension from Anaconda.

Neither of these facts seems startling under the circumstances, but the Senatorial horror expressed was all that was needed to kill Lyon's chances. John L. Lewis, all set to blast Lyon at next day's hearings, never got a chance to testify.

This reversal quickly launched a search for explanations.

JENKINS PRACTICAL PIPING LAYOUTS **63**

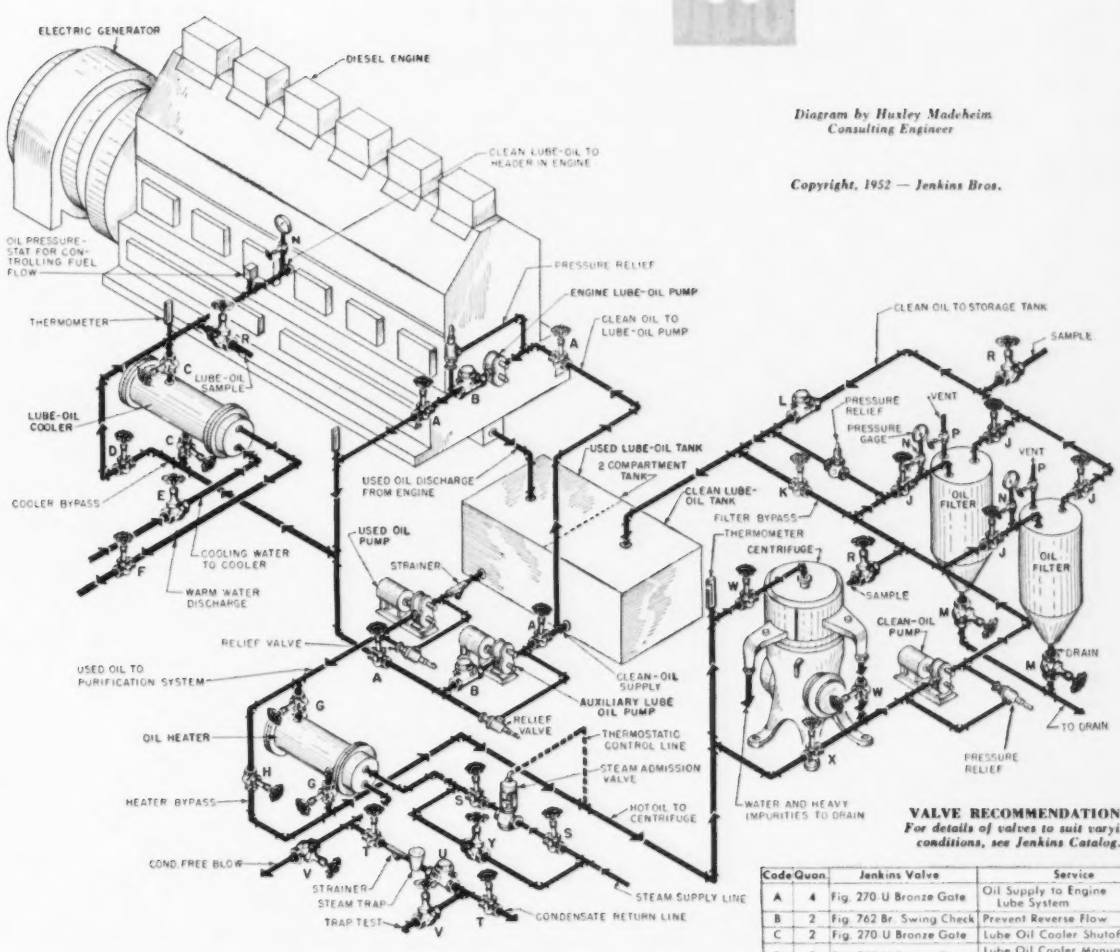


Diagram by Huxley Madeheim Consulting Engineer

Copyright, 1952 — Jenkins Bros.

How to plan a LUBRICATION OIL PURIFYING SYSTEM FOR DIESEL ENGINES

Lubrication oil purification systems are used on practically all modern diesel engines to assure longer oil life and decreased engine maintenance. Purification, however, must be accomplished without removing beneficial oil additives which increase lubricant efficiency and preserve bearing surfaces.

The diagram above shows a typical lubrication oil purification system designed to meet diesel engine needs. Circulated oil from the engine is returned to a tank and part or all of it is pumped through a heater. Here, it is raised to optimum cleaning temperatures. A centrifuge then removes water and impurities. The partially cleaned oil next passes through filters, where light impurities and colloidal carbon are removed.

In normal operation of the diesel, the lube-oil enters a clean oil storage tank, after which it is pumped back to the engine through a cooler, generally a shell and tube heat exchanger with water as the coolant, which reduces oil temperature raised during purification.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installations.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17.

Complete description and enlarged diagram of this layout free on request. Includes additional detailed information. Simply ask for Piping Layout No. 63.

VALVE RECOMMENDATIONS
For details of valves to suit varying conditions, see Jenkins Catalog.

Code	Quan.	Jenkins Valve	Service
A	4	Fig. 270-U Bronze Gate	Oil Supply to Engine Lube System
B	2	Fig. 762 Br. Swing Check	Prevent Reverse Flow
C	2	Fig. 270-U Bronze Gate	Lube Oil Cooler Shutoff
D	1	Fig. 270-U Bronze Gate	Lube Oil Cooler Manual Bypass
E	1	Fig. 950 Bronze Globe	Cool Water Supply to Lube Oil Cooler
F	1	Fig. 270-U Bronze Gate	Water Discharge Shutoff
G	2	Fig. 270-U Bronze Gate	Oil Heater Shutoff
H	1	Fig. 270-U Bronze Gate	Oil Heater Manual Bypass
J	4	Fig. 270-U Bronze Gate	Oil Filter Shutoffs
K	1	Fig. 270-U Bronze Gate	Oil Filter Manual Bypass
L	1	Fig. 762 Br. Swing Check	Prevent Reverse Flow
M	2	Fig. 950 Bronze Globe	Filter Drains
N	3	Fig. 743-G Br. Needle	Pressure Gage Control
P	2	Fig. 950 Bronze Globe	Filter Air Vents
R	3	Fig. 950 Bronze Globe	Oil Sampling Take Offs
S	2	Fig. 270-U Bronze Gate	Steam Supply to Oil Heater
T	2	Fig. 270-U Bronze Gate	Condensate Shutoffs
U	1	Fig. 762 Br. Swing Check	Prevent Condensate Backflow
V	2	Fig. 950 Bronze Globe	Condensate Bypasses Free Blow Trap Test
W	2	Fig. 270-U Bronze Gate	Centrifugal Shutoff
X	1	Fig. 270-U Bronze Gate	Centrifugal Bypass
Y	1	Fig. 956 Bronze Globe	Bypass on Automatic Steam Valve

JENKINS VALVES
LOOK FOR THE DIAMOND MARK
SINCE 1864 TRADE JENKINS MARK
Jenkins Bros.

Why should you consider using

HERCULES Red-Strand wire rope

Why indeed. Aren't all wire ropes alike? They look alike. Why should you choose HERCULES Red-Strand rather than any other?

The answer would be easy if you could discover by *feel* why HERCULES Red-Strand performs so well. Or if you could see, or hear, or taste the *special quality* that makes users praise it so highly. But you can't. Wire rope isn't like that.

The big reason is performance

Usually you become aware of the consistently high performance of HERCULES Red-Strand by hearing users praise it . . . or by using it yourself and checking results.

Then you realize there must be *something special* about this rope. And you are right. *There is.*

What is this something special?

It is partly the result of generations of specialization. Leschen is concerned *entirely* with making wire rope. Nothing else. No other processes or activities interfere.

It is partly Leschen's 97 years' experience and Leschen's natural ability to make good wire rope . . . which has resulted in several major "firsts" in the development and most efficient use of wire rope.

It is partly pride of craftsmanship . . . from policy to engineering to finished rope. It is the effort always to make HERCULES Red-Strand *better than we claim it to be.*

In a word, it is *quality* . . . higher-than-rated quality. This is the *something special* in HERCULES Red-Strand wire rope that means *longer-than-expected* service . . . year in, year out.

It *pays* to choose HERCULES Red-Strand. Use it and see.

HERCULES® Red-Strand Wire Rope made by
A. LESCHEN & SONS ROPE COMPANY
St. Louis 12, Missouri

In business only to make wire rope and slings of higher-than-rated quality—since 1857

LESCHEN

SLINGS & WIRE ROPE

HIGHER-THAN-RATED QUALITY

Washington Impact *(Continued)*

Lyon, having made no secret of his opinions or income at any time, felt badly used. Eisenhower was reported in a knuckle-rapping mood, but whose knuckles? There seemed no clear answer, as June ended.

Search for a Bureau director now becomes a formidable problem. It's unlikely John Forbes will remain, but John L. Lewis is determined to fight almost anyone else. One answer, now being considered, is to separate the mine safety function from the Bureau altogether.

Independent Mining Agency

This year's most ambitious legislative plan for mining, a bill by Rep. A. L. Miller (R., Neb.), Chairman of the House Interior Committee, to create an independent Federal Minerals Corporation, has failed to get off the ground. The bill should not be confused with Sen. Ed. Johnson's bill to create a market-supporting minerals credit corporation.

The Miller bill would abolish the Bureau of Mines and Geological Survey, and transfer their functions to the new agency. Metal and mineral functions of other agencies such as ODM and GSA would also be transferred. The objective would be to gather all governmental functions affecting mining into one independent agency, the way farm activities have been centralized in the Agriculture Department.

The bill's sponsors deliberately called the proposed agency a "corporation" instead of a "department," believing prospects for passage would be brighter. They have been stymied, however, by the House parliamentarian, who referred the Miller bill to the Banking and Currency Committee, not to Miller's own committee. Because of its heavy agenda and negligible interest in mining matters, the Banking Committee has pigeonholed the bill.

Rep. Miller plans to reintroduce his bill next year, changing the proposed agency's status from a corporation to a department or independent office. This would allow his own committee to consider the bill. Some proponents of the bill are reluctant to go whole-hog and propose a new Cabinet-level department immediately. First, they would create an independent mining agency on an administrative par with the former Federal Security Agency; then wait for an opportune time to boost the new agency to departmental status, following the example of FSA's promotion to a Department of Health, Education, and Welfare.

Curiously, the Senate Interior Committee has shown little enthusiasm for the Miller bill. One possible reason: Its staff was barely consulted in the bill's preparation.

Most observers doubt that an independent mining agency will be set up. For one thing, both Congress and the adminstration are reluctant to create big new agencies. For another, mining has more ramifications than agriculture, and strong arguments, can be made against separating mining from closely-related functions of agencies like ODM.

One big stumbling-block to creation of an independent mining agency is the lack of solid industry support for the proposal, but Miller bill proponents forecast the buildup of such support if and when the depression in lead and zinc should spread to other domestic mining industries.

LABOR THIS MONTH

Joseph M. Gambatese, McGraw-Hill Washington News Bureau

NO WAGE PATTERN: There is no fixed pattern of wage increases this year. Most boosts vary between 5 and 10¢ an hour. As forecast, Basic Steel settled, without a strike, for less than 10¢—8½¢. Auto workers netted about 6¢. Electrical workers almost 7¢. West coast longshoremen got 6¢ through arbitration.

COPPER MINING A THREAT: Government conciliators have their eyes on nonferrous mining as the next big threat to labor peace this summer. Except for east and Gulf coast shipping, other major wage negotiations have been concluded peacefully. Mine, Mill and Smelter Workers want 15¢ an hour, plus fringe benefits. They'll settle for half that, if they can get it. Other bargaining ahead: coal and railroads, Oct. 1.

TAFT-HARTLEY REVISION PUT OFF: Amendments to the labor law will have to wait until next year—at least. Congress won't have time to act this session. Revision even next year is doubtful. Basic difficulty: too much disagreement on what should be done.

HANDLING COMMUNIST LABOR LEADERS: This problem will be explored further by the Senate Judiciary Committee. It plans to hold hearings on a bill by Sen. Butler (S. 1606). The bill would immediately deny Taft-Hartley benefits to a union accused of being Communist dominated pending a hearing and final decision by the Subversive Activities Control Board. Intent is to eliminate much of delay under present security statute.

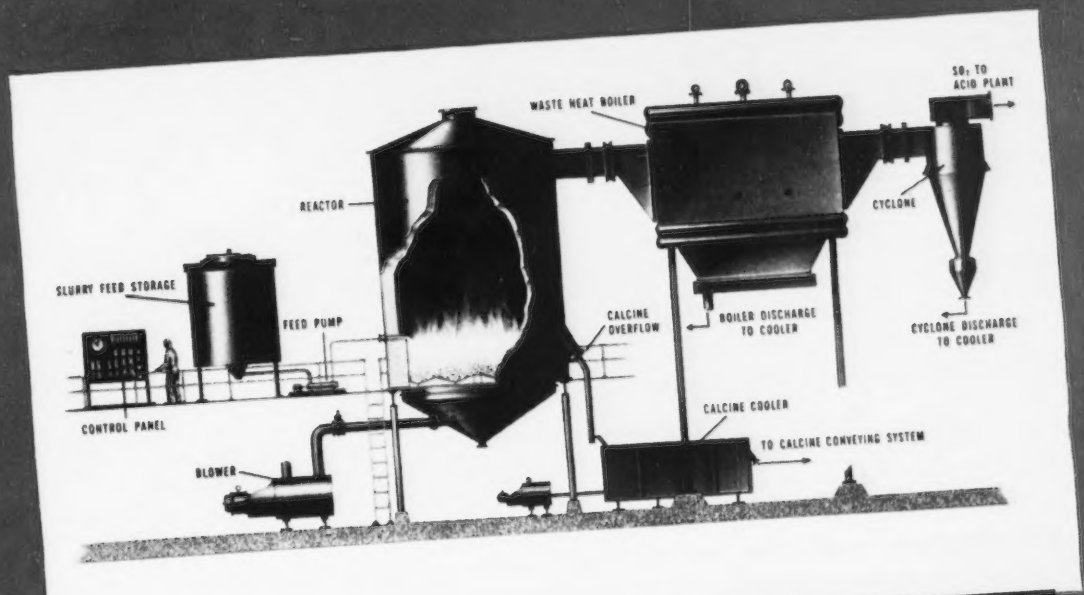
RIVAL UNIONS EYE MINE-MILL: AFL and CIO unions are turning the heat on Mine-Mill. A "no-raid" agreement between AFL and CIO will take effect in January. It will leave these organizations more time and money to spend against Mine-Mill and to organize non-union mines. Merger of AFL and CIO would hurt Mine-Mill still more. AFL metal unions have consolidated and set up Denver headquarters to fight Mine-Mill.

AFL FAILS AT EMPIRE ZINC: Mine-Mill repelled offorts of AFL to make gains in Silver City (N.M.) area, winning election, 53 to 27. This despite Mine-Mill's 15-month strike a year ago. Jencks and Lopez handled pre-election campaigns. Mine-Mill predicted another victory in next clash with AFL at Kennecott mill at Hurley, N.M.

LABOR TURNING TO PUBLIC RELATIONS: Now that organized labor has come of age, it is getting more conscious of public relations as an aid to winning members, being accepted in a community and influencing legislation. Tough-guy tactics are being discouraged. You can see it in new efforts to clean up corruption, and in more peaceful settlement of disputes.

IT'S A FACT: The $313-million steel companies paid for pensions, unemployment compensation, social security and other "fringe" benefits last year was more than the industry paid the owners in stock dividends. . . . Wage-hour administrator extended until Oct. 1, the deadline for putting pay practices regarding exempt white-collar employees in line with new wage-hour rules. . . . CIO Steel Workers obtained a bargaining election at Homestake Mining Co.'s gold mine at Lead, S.D. . . . Donald Conners, who quizzed Mine-Mill officials for the Internal Security Subcommittee at Salt Lake City last October, has left the committee staff to practice law in San Francisco.

Alcan First to Roast Zinc Concentrates with DORRCO FLUOSOLIDS System



Produces SO_2 for Contact Acid Plant and Desulfurized Zinc Calcine for Leaching

ARVIDA, QUEBEC. First commercial installation for fluidized zinc roasting, a Dorrco FluoSolids System has been on stream at the Aluminum Company of Canada's plant here since June, 1952. Alcan's expanding primary aluminum capacity has increased their sulfuric acid requirements and FluoSolids was selected as the most economically and technically feasible method to produce SO_2 from zinc sulfides for contact acid manufacture. It frees this company from fluctuations in natural sulfur supplies and at the same time gives a calcine ideally suited for electrolytic zinc production.

SYSTEM ROASTS 150 TONS PER DAY

Results from the first year of operation have been completely satisfactory. Gas strength at the Reactor stack averages 10-12% SO_2 . . . a safe margin over the 7% SO_2 required at the converter. The close temperature control possible with FluoSolids has resulted in a combined calcine product averaging 0.3% sulfide sulfur . . . which is the specification on this calcine for electrolytic zinc.

HOW THE SYSTEM WORKS

Zinc sulfide concentrates, obtained from the Northern Quebec areas, are repulped and held in slurry form at about 80% solids in Dorr Agitators. Slurry is pumped into the Reactor and is immediately dispersed and brought to the uniform roaster temperature of 1600°F. Gas passes out the side of the Reactor, through a waste heat boiler and cyclones before going to the acid plant. Calcine is cooled and stored prior to shipment to the zinc refinery.

FOR ZINC PRODUCERS . . .

FluoSolids represents a development of major significance. As proven by the Alcan installation, with this new technique a low uniform temperature can be maintained to produce a calcine with high zinc solubility . . . and at the same time good waste heat recovery can be effected — nearly nine-tenths of a pound of steam per pound of zinc concentrate . . . a strong gas is produced averaging 10-12% SO_2 . . . and there is no necessity for drying nor for fine grinding the roaster feed. In those cases where calcine is sintered, any desired amount of sulfur can be retained, still producing a high strength gas. If you'd like more information on FluoSolids . . . the most significant advance in roasting technique in the last 30 years . . . write The Dorr Company, Stamford, Conn., or in Canada, The Dorr Company, 26 St. Clair Avenue East, Toronto 5.

FluoSolids is a trademark of the The Dorr Company, Reg. U. S. Pat. Off.

MINE EXPANSION—WORLDWIDE

MODERNIZATION PROGRAM at Kennecott Copper Corp.'s Arthur Mill in Utah, involved the recent change from 56-in. step-down type Fagergren flotation machines to the new larger trough-type Fagergren machines (above). The Arthur mill treats ore from the copper mine at Bingham Canyon.

Highlights in Domestic Iron Ore Program

SEVERAL LARGE NEW projects are being developed by Lake Superior operators, having to do with direct-shipping ores. Included are Pickands, Mather & Co.'s Peterson mine at Bessemer, on the Gogebic Range (to be operated by the Puritan Mining Co.); M. A. Hanna's Cannon mine on the Menominee Range; Jones & Laughlin's Tracy mine, at Negaunee on Marquette Range. Oliver's Sherman group of eight mines includes underground and open-pit operations, as well as a 7-million-ton crushing, screening and sizing plant. Several smaller properties are being prepared for mining, most of them on the Mesabi.

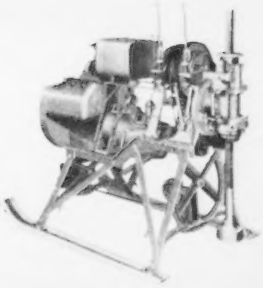
Puritan Mining Co., owned jointly by Youngstown Sheet & Tube Co. and Bethlehem Steel Co., is managed by Pickands, Mather & Co. Four old properties, the Puritan, Ironton, Yale and Colby, operated by various interests in the past down to 2,000 ft., have been combined under a new name, the Peterson, this in honor of Arthur F. Peterson, vice president, in charge of Bethlehem's Mining Division. The purpose is to recover new ore found at depth and continuous through the properties. The Peterson is expected to be one of Michigan's largest producers. Development is expected to cost millions. Surface structures costing $450,000 have been built by Proksch Construction Co. The shaft is being sunk to the 3900 level. Central operation at that depth is the objective.

M. A. Hanna Co. has been engaged in opening four mines in the Lake Superior district which, it is expected, will produce more than 5-million tons per year eventually. Outstanding in the group is the Cannon mine, near Stambaugh, on the Menominee Range. Three mines have been merged to make the Cannon. A 15½x20-ft. concrete-lined shaft is being sunk to a point 950 ft. below the surface. Two 12-ft. drum hoists, driven by two 1,000-hp. dc motors, will be installed. The man hoist will have one 1,000-hp. dc. motor.

J. & L.'s Tracy mine, at Negaunee, is scheduled to start producing in 1954 and eventually to turn out 1-million tons per year. A shaft has been sunk in order to work the large body of direct-shipping ore shown by drilling. A large tonnage of low-grade ore exists on surface adjacent to the shaft, which ore some day will be recovered by open-pit operation.

A new open-pit mine, of which there have been only a few in the Michigan Iron Country, is being opened by Pickands, Mather & Co. on the site of the old Bristol property, worked 30 years ago, near Crystal Falls, Mich. This is the Fortune Lake. Stripping of 2½-million cu. yd. is being done in an area about 1,300 ft. long by 400 ft. wide by Peter Kiewit & Son, Omaha, Neb., to uncover 1½-million tons of ore. This will be mined in the next

(Continued on page 186)

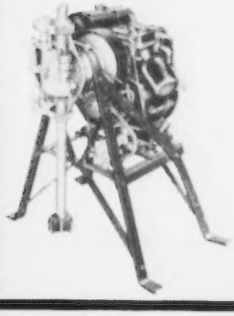


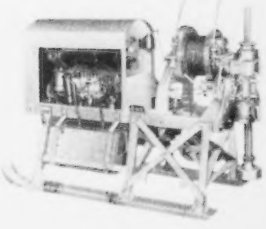
BBS-1

World's best known surface drill. Handles "E" rods to 1000 ft. "A" to 800 ft.

X-RAY

Compact, portable - - 185 lbs. net. Takes ¾" core to 200 ft.. Low fuel consumption.





BBS-2

Versatile, choice of 5 swivelheads. Depths to 2400 ft. Gas or diesel.

BBS-4

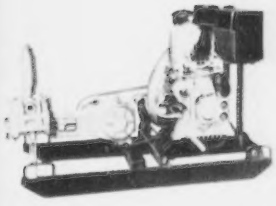
Drills to 5000 ft. with "B" rods. Moves under own power. Gas or diesel.

PERMASET BITS

(Powdered metal). All standard sizes available from stock. Also reaming shells, etc.

DRILL PUMPS

5-12 and 4-7 models. Capacities 400 to 1200 g.p.h. Diesel motor optional on 5-12.

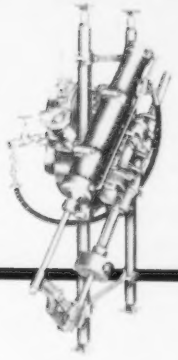


If it's for **DIAMOND DRILLING**

WE LOOK INTO THE EARTH

BOYLES BROS
DRILLING COMPANY LTD.,
VANCOUVER, CANADA

...WE MAKE IT!

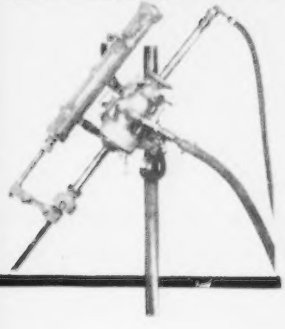


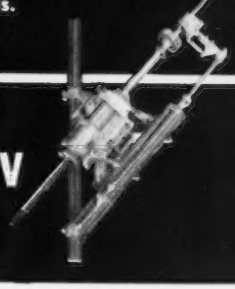
BBU-2

Rugged. Capacity, 1800 ft. with "E" rods, 1400 with "A". Four gear feeds.

VB and VC

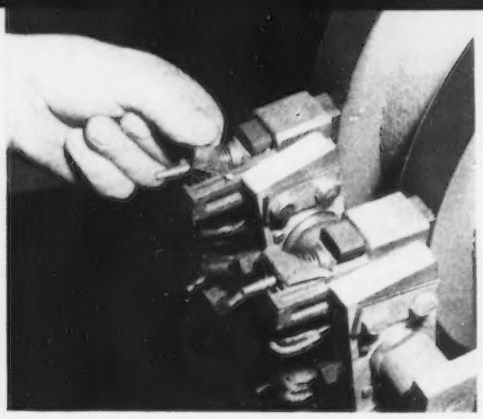
6" vane motor, 4 feed swivelhead. 2 forward 1 reverse speed transmission for blasthole or coring to 800 ft. (E size).



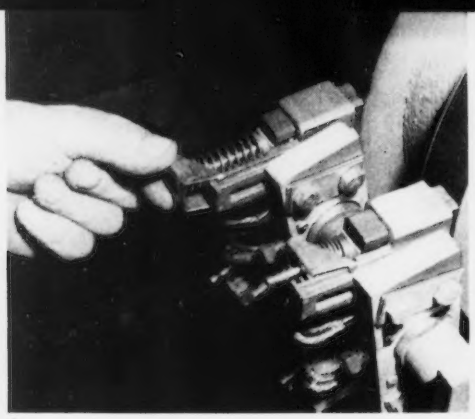


JV

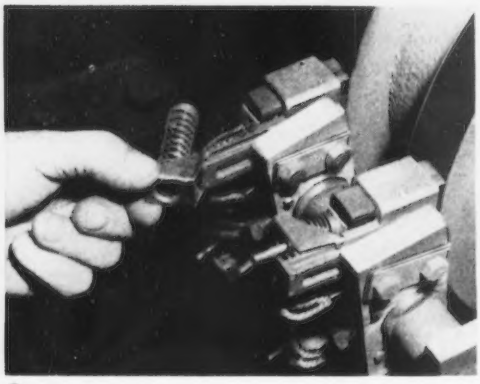
4 feed swivelhead. Capacity 800 ft. with "E" rods. JVR with reverse and right hand feed screw for blastholes.



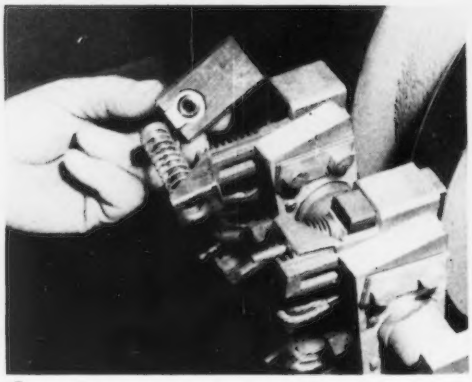
1 To reset brush tension, operator releases spring lock . . .



2 slides it back to relieve pressure . . .



3 and swings locking device to one side . . .



4 for fast and easy brush removal.

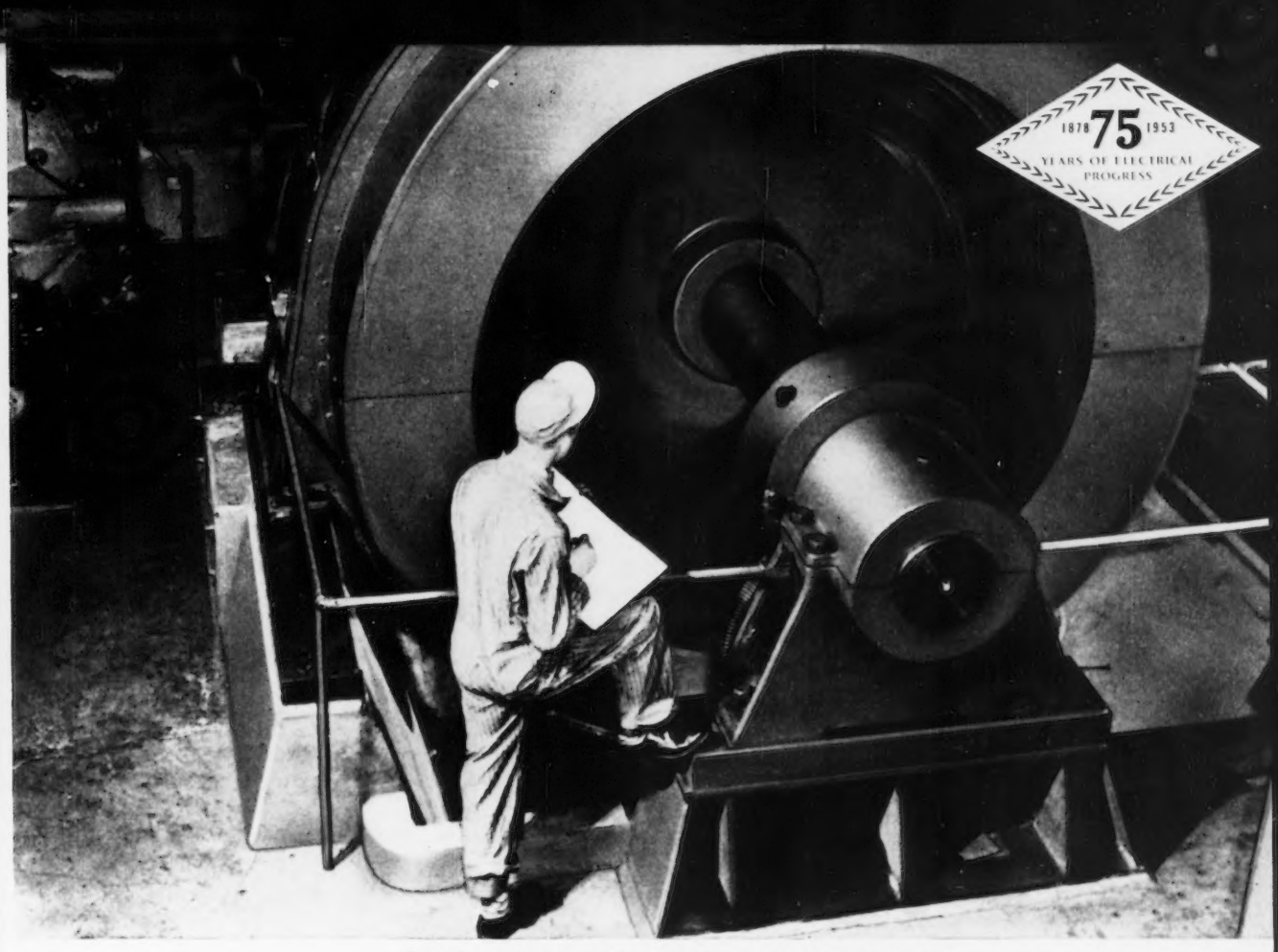
BRUSH-PRESSURE ADJUSTMENT, for maximum brush life, and replacement, to assure reliable motor service, are simple matters on G-E synchronous motors. A calibrated spring-loaded brush holder makes resetting brush tension or removal of brushes fast and easy. Brushes are staggered for even brush-ring wear.

See How Routine Maintenance Is

BEARING LUBRICATION can be readily checked through a large sight-level gage on the bearing pedestal; and when oil is required, handy snap-top covers are provided for easy refilling, as well as oil-ring inspection. A drain plug is conveniently located for quick oil changes.

INSULATION CLEANING is fast on G-E synchronous motors. Windings are coated with a high-gloss Glyptal* varnish that resists the accumulation of dust and can be vacuum or air cleaned in most applications. In extremely dusty or oily atmospheres, deposits can be easily wiped from the windings. Clean windings mean longer insulation and machine life.

*Reg. trademark of General Electric Co.



This G-E compressor motor is typical of the large synchronous motors G.E. supplies the mining industry for ball-mill and other drives.

Easier on G-E Synchronous Motors!

Routine maintenance involves three factors: brushes, lubrication, and insulation. To be sure that these areas are properly serviced, G-E synchronous motors have design features that make checking easy and maintenance fast. Close at hand and easy to adjust, the brush-rigging construction encourages your maintenance men to inspect regularly. Oil-level gage and inspection caps are arranged for quick checking and filling when necessary. The high-gloss insulation on G-E synchronous motor windings resists the adhesion of dust and minimizes the need for cleaning.

These features promote long, reliable motor service and save valuable time for your maintenance crews.

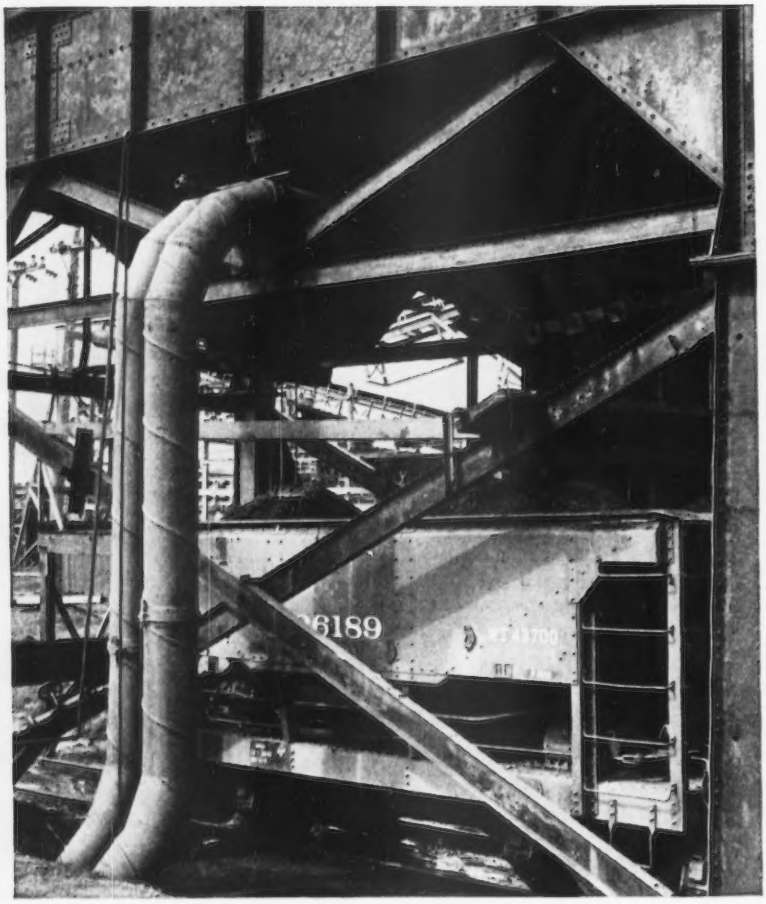
Before selecting your next heavy-duty motor, be sure to consider these important maintenance features. Call in your G-E representative. He will be glad to discuss the many money-saving applications for G-E synchronous motors. Meanwhile, you can obtain more information on G-E synchronous motors by requesting the following publications: GEA-5332, "Low-speed Synchronous Motors" or GEA-5426, "High-speed Synchronous Motors." Write to Section 770-28, General Electric Company, Schenectady 5, N. Y.

You can put your confidence in—

GENERAL ELECTRIC

NAYLOR PIPE...

Gets around wherever you need it



You can always depend on this distinctive, extra-strong lightweight pipe to carry the load. That's why you see so much of it on the job in mining service—whether it's for tailings, water supply or high and low-pressure air. Bulletin No. 507 will give you the details.

NAYLOR PIPE COMPANY
1243 East 92nd Street, Chicago 19, Illinois
New York Office: 350 Madison Avenue, New York 17, New York

Iron Ore *(Continued)*

three years. The rest will be mined underground eventually. Estimated cost of development is about $3¾-million.

Other New Projects

Bethlehem Steel's Grace mine, near Morgantown, Pa., is expected to produce 6,000 tons of high-grade concentrates daily from 9,000 tons per day of mill feed, and to hoist a total of 12,000 tons per day of ore and waste. Two shafts have been sunk. Mining is expected to begin in 1955. A magnetometric survey run in 1948 gave the first evidence that the orebody existed. The ore averages about 44% in iron.

Bethlehem has also acquired iron claims north of Lake Bowman, Calif., which will be worked by open pit. Over 1,000,000 tons is said to be obtainable.

At Benson Mines, northern New York, Jones & Laughlin Steel Corp. has been conducting an expansion program involving expenditures of $7,-500,000, which will yield over 1½-million tons of concentrates for the company's furnaces this year. Further expansion of production to 1.9-million tons per year is planned for the next few years. Something over a half million tons of this will be martite, the rest magnetite. New equipment to process the non-magnetic martite was put in service about one and one-half years ago.

Richard Ore Co., northern New Jersey, recently bought with its parent E. & G. Brooke Iron Co. by Colorado Fuel & Iron Corp., obtained a certificate of necessity, for amortizing some $85,000. This mine has supplied about 185,000 tons per year of high-grade magnetite and concentrates to Brooke's blast furnace in Pennsylvania.

New Mexico

In New Mexico some miners are preparing to ship to C.F.&I.'s Pueblo plant. This state's reserves are put at about 140-million tons of ore, half of which runs 35% iron and the rest under this.

Yolo Steel & Metal Co., Calif., plans a plant near Sacramento producing 1,000 tons of pig iron daily. It has leased property with high-grade iron near Redding, also other iron properties elsewhere in the state.

Utah

Utah's commercial iron ore in Iron and Washington counties, an important source of ore for Western steel making since 1923, has been set at 200-million long tons in a compilation issued by U. S. Steel. Pinto Iron Springs deposits worked extensively, especially since the Geneva plant was built and which are now being used, run 45-50% iron, Bull Valley deposits about 53%.

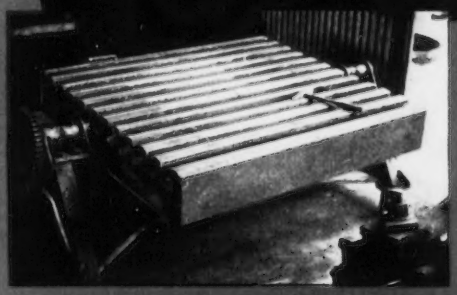
(Continued on page 188)

WARPAGE CONTROL ...

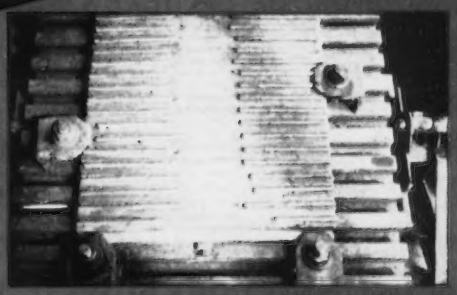
KEY TO HARD-FACING CRUSHER JAWS!

WHAT makes for success in hard-facing crusher jaws? Two major factors: Choice of the right Stoody Alloy and control of warpage during welding operations! Here's a procedure in use today giving quick buildup, excellent wear protection and relative freedom from distortion. The completed jaws, protected with STOODITE, *processed 40% more material than jaws protected with a competitive alloy!*

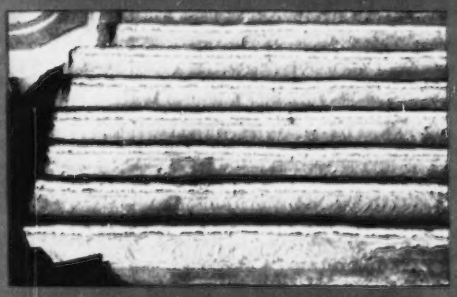
STOODITE offers high wear resistance with excellent impact strength—and bonds strongly with manganese steel. Your Stoody Dealer will gladly give details and additional application information. *Look for him under "Welding Equipment & Supplies" in the Yellow Pages.*



1 Heavy welding jig is essential. This one is composed of railroad irons welded together, with rails furnishing top surface. Table can be tilted to facilitate down-hand welding on corrugations.



2 Jaw is securely clamped on table. Manganese bars are tacked in sections with Stoody Manganese along worn corrugations. Bars build up size quickly; sections permit skip welding which equalizes heat, lowers distortion.



3 Sides of corrugations are built up with Stoody Manganese. Stoodite stringers bring top to sharp vee. Sides of corrugations are then surfaced with Stoodite. Skip welding is necessary.

4 Warpage is checked with straight edge on back side then shrink welds are applied along webs to equalize tension. Occasional checking with strap-iron fixture indicates progress. Finished jaw is flat within 1/32".

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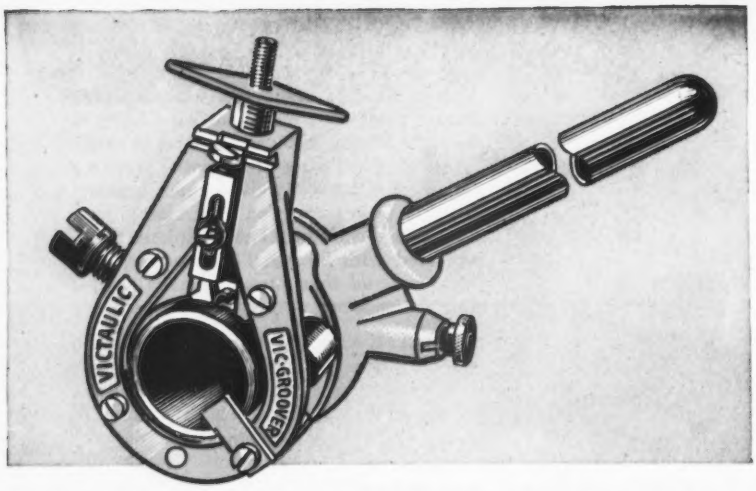

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Iron Ore *(Continued)*

Nevada

The Lovelock Area, in Pershing County, is credited with a production of about 561,000 long tons of iron ore to the end of 1952. Of this tonnage only some 60,000 tons has gone into domestic steel production.

Iron mining started in the area about 1943 at the Segerstrom-Heizer mine and reached a high of 48,690 tons in 1944 when the crushed ore was used as a concrete aggregate ballast by the ship-building industry. Production then dropped until the latter part of 1951 when the demand from Japan for iron ore stimulated iron mining in the West. Work was then resumed at the Segerstrom-Heizer, operated by Dodge Construction Co. and 153,600 tons was shipped in 1952. Their total production to the end of last year was about 236,000 tons. They are now, or at least were recently, mining about 30,000 tons per month.

During 1950 and 1952, several other deposits at Lovelock were also mined, the greatest production coming from the Buena Vista mine owned and operated by Mineral Materials Co., of Alhambra, Calif. This company mined 283,000 tons from October, 1951, to Dec. 31, 1952; their Japanese contracts were filled at the end of 1952 and except for a small leasing operation, shipping ore for domestic use, they have ceased mining in Nevada.

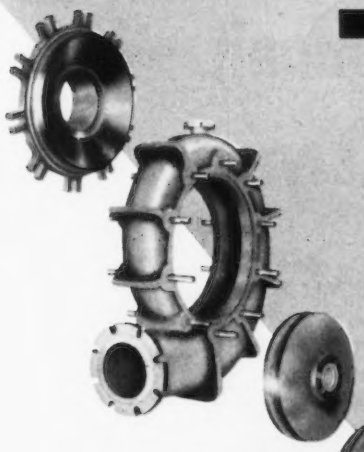
Other iron operations in the Lovelock area are the Thomas mine and that of Parker Brothers, who both ship ore for domestic use only. H. S. Thomas has a small substantial operation which he started in 1950, and to the end of 1952, had produced 31,070 tons. Parker Brothers, of Marysville, Calif., mined about 10,000 tons during 1952.

At present Thomas and Parker Brothers are still mining for domestic use only; and, in the light of the economics, Dodge Construction could be expected to do the same at the Segerstrom-Heizer mine when their Japanese contracts are filled, which should be about now. Nothing has been said about the future operation at this property; however, the grade of the ore is such that it is thought they can do better shipping high-grade "hard lump" ore for use in open-hearth steel furnaces.

In other parts of Nevada, it is estimated roughly that about 300,000 tons was shipped from the Modarelli deposit south of Palisade (by Simplot), and the same amount from the Phelps Stokes deposit, near Gabbs, by the Standard Slag Co. In the McCoy district, south of Battle Mountain, about 50,000 tons of iron ore was shipped. Near Yerington, Standard Slag operated another deposit, said to be important. A venturesome guess would put this production at about 20,000 tons. All of this ore went to Japan, and these operations are shut down.

(Continued on page 192)

THE NEW GIW SLURRY PUMPS



The pumping of finely divided, highly abrasive solids has become a major problem in the mining world. It is also often desirable to pump these slurries at high solid concentrations and over a wide range of heads and capacities.

Recognition of these circumstances has led Georgia Iron Works Co. to design a completely new line of pumps for the job.

The performance of these pumps is documented by two years of laboratory and field investigations. Their capacities range from 50 to 8000 GPM against heads up to 150'.

Write for our illustrated booklet describing the Slurry Pumps. We solicit your inquiry and if you wish, there is a representative near you who will call.

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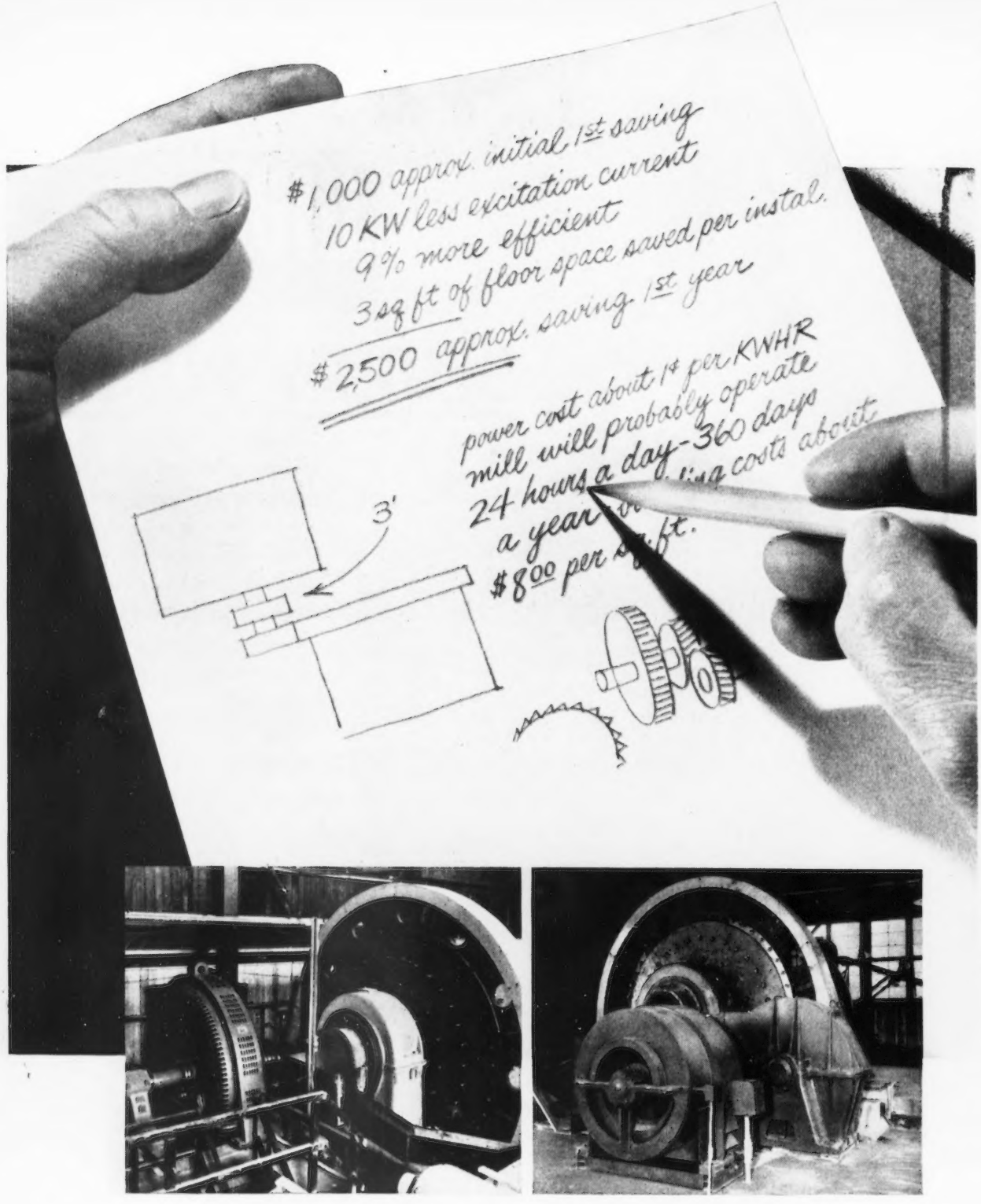
$1,000 approx. initial 1st saving
10 KW less excitation current
9% more efficient
3 sq ft of floor space saved per instal.
$2,500 approx. saving 1st year
power cost about 1¢ per KWHR
mill will probably operate
24 hours a day - 360 days
a year
$8.00 per
3'

CHOOSE THE BEST . . . Westinghouse 700-hp, low-speed synchronous motor driving ball mill on left; 700-hp, high-speed synchronous motor and speed reducer on right. Both do a good job of driving the mill, but in this case the motor-speed reducer saves $2,500 per unit in initial costs, power consumption, building expense and installation costs.

Westinghouse drive proposal offers savings of $2,500 per ball mill

The drive, at bottom left, is a Westinghouse low-speed synchronous motor. The other is a combination Westinghouse high-speed synchronous motor and a Westinghouse speed reducer. Both drive wet grinding mills in an iron ore beneficiation pilot plant in Minnesota. The Westinghouse motor-speed reducer unit offers one company savings of $2,500 per ball mill in its planned plant expansion program which will use many such units. It's a good example of how Westinghouse can suggest cost-saving methods of planning a job.

Proposal saves four ways

The company originally planned to use just the low-speed synchronous motors to drive ball and rod mills. Our engineers carefully studied the application and suggested possible savings through the use of high-speed geared units. These units offered reductions in initial costs, power consumption, building expense and installation costs.

Here are the figures

Each motor-speed reducer combination, in this case, costs roughly $1,000 less than a low-speed drive and requires 10 kw lower excitation current. Also, each motor-speed reducer unit is .9% more efficient and saves about three feet of floor space. Concrete pits for the motors are eliminated. Figuring average power and building costs, plus lower initial investment, each motor-speed reducer offers initial savings of $2,500 per unit and continued power operating costs.

What does this mean to you?

It means that because of our wide range of equipment and thorough knowledge of mining industry needs, Westinghouse can study your requirements and suggest the best method for doing the job. We help you get the most out of your investment in electrical equipment.

Put this application assistance to work for you

If you are planning an expansion, modernization or just want to find ways of doing things better electrically, call your Westinghouse representative. He'll help you get benefits like this. Or write: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. J-94997

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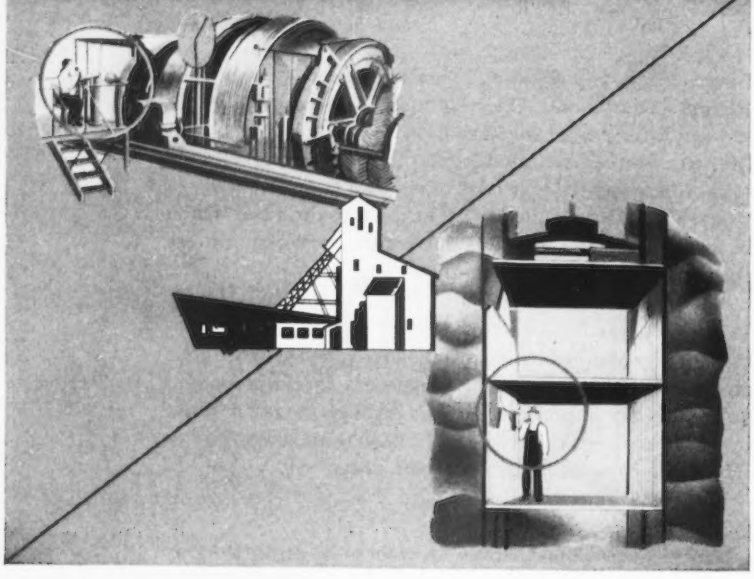

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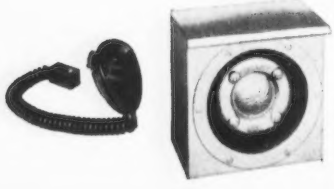
COMMUNICATION
IN DEEP-SHAFT MINES



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Iron Ore *(Continued)*

North of Jungo, W. G. Austin and Tom Beko, of Reno, started a small operation in the summer of 1952 and to date have shipped about 52,000 long tons east for domestic use.

Most of the domestic ore from Nevada is going to Youngstown Sheet and Tube Co., some to Ford Motor Co., some to Kaiser at Fontana, and some to small furnaces on the Pacific Coast.

The grade of most of the ore going to Japan was between 56 and 58% iron; however, the Segerstrom-Heizer ore probably averaged about 62%. Ore shipped for domestic consumption usually contains 62 to 64% iron, less than 0.1% sulphur, and less than 0.3% phosphorus.

It is to be noted that no mention is made here of the iron deposits near Dayton, Nev. This iron ore is generally of too low a grade, and no appreciable quantity could be mined that would come up to the specifications for either Japanese export ore or "lump" ore.

Reserves are difficult to estimate except in a few cases. It is understood that drilling at the Modarelli deposit by Simplot indicated about 20 million tons of iron ore; however, there is no information as to the grade estimated for this tonnage. The Lovelock area is estimated to have 1 to 2 million tons reserve of ore containing 57 to 62% iron. The total reserves of all other known deposits in Nevada is estimated at about 1 million tons.

"Most of us that are interested in the iron ore picture in Nevada," states this correspondent, "are of the opinion that we are now in the transition state between the relatively large shipments to Japan and a more stable business dependent on helping to supply the 'hard lump' ore required in the United States. This will mean a small production at a somewhat higher price."

Direct Reduction Also for Low-Grade Ores

INTEREST IN THE Krupp-Renn process for treating low-grade siliceous iron ores to obtain their iron by reduction in a rotary kiln is on the increase. P. E. Cavanagh (*Metal Progress*, March, 1953) finds that commercial production of sponge iron has increased from about 20,000 tons per year to 50,000 tons and will reach 200,000 tons in the next two years, considering only Sweden and Mexico. The steel company Hojalata y Lamina, in Monterrey, N.L. is treating lump Durango ore in what is the first tunnel kiln sponge iron plant in North America, capacity being 10,000 tons per year. In Sweden another Wiberg-Soderfors furnace has been installed and six others are being built or planned. No serious consideration can as yet be given, in Cavanagh's opinion, to commercial production of

6 x 36 WS PREformed Right Lang Lay
Monarch Whyte Strand with IWRC

What's unusual about this machine?

This is a 6 x 36 PREformed rope, made up of 265 wires. That means 265 individual moving parts.

Because any wire rope is a complicated piece of machinery, it must be precision built.

There are 8 different sizes of wire in this rope — each drawn to exacting specifications for material and size.

Outside wires are one size. Inside wires are another. Core and filler wires are still other sizes.

All wires are cold-drawn to precise diameters so they will fit with snug uniformity into the structure of each strand.

Each wire is protected with lubricant applied during fabrication of the rope.

Macwhyte makes a thousand and one ropes to meet the needs of every type of equipment. Each is built with the exacting care that long, low-cost service demands.

Prompt recommendations from Macwhyte engineers are readily available without obligation.

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all-steel cell construction—With *steel* negative plates, *steel* positive plates and *steel* cell containers, EDISON batteries are built to take real punishment. They've been in locomotives that have fallen down mine shafts and rolled down dumps . . . yet have gone right back on the job.

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STORAGE BATTERIES

Low-Grade Ore *(Continued)*

sponge for melting stock in most places in Canada and United States under prevailing prices of scrap, labor and raw material and with conventional processes.

At Airlie, Transvaal, South Africa, according to another source, Dominion Iron & Steel Co. proposes to install one kiln of a capacity of 70,000 tons of lüppen per year and eventually two more. Registered capital is $4.2 million, the amount subscribed being unknown.

Serious talk is reported about installing a kiln in Israel, using coke breeze for fuel. One has been under construction in Spain for three years. Czechs are said to be installing some 12 or 14 kilns. Germans are reported to be going ahead with six new kilns using highly siliceous Salzgitter ore.

Expansion in U.S.

ALASKA

Engineering Enterprises. Plans have been made to mine Shorty Creek in the Haines Junction Area with dragline, "cat," and "dozer" probably to be supplemented later with one of John Miscovich's "Intelligiants."

United States Smelting, Refining & Mining Co. has expanded gold dredging operations in Alaska to include the Chicken Creek district. Stripping has begun.

Zenda Gold Mining Co. has developed a rich tin deposit in the Port Clarence district. Dredging operations are planned for 1953.

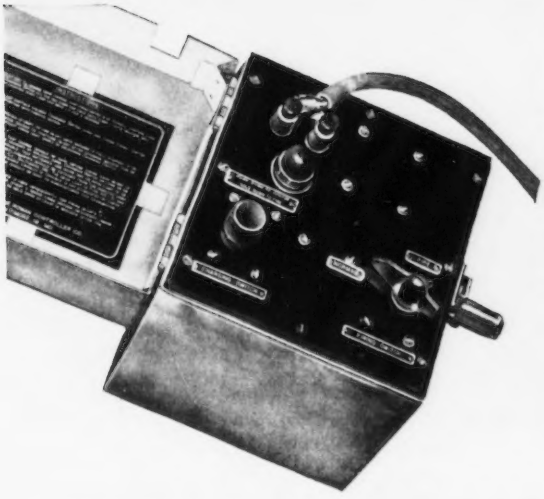
ARIZONA

ASARCO. Project: Open-pit copper mine and mill at Silver Bell. Investment: $17-million. Grade of ore: —1% copper. Production rate: 7,500 tons of ore per day; 18,000 tons of copper per year. Capacity output: 1954.

Bagdad Copper Co. Project: Open-pit copper mine, mill expansion, and leaching plant at Bagdad. Investment: $14-million. Reserves: 30-million tons 0.754% copper (sulphide ore); 30-million tons 0.435% copper (oxide ore). Production rate: 9,000 tons ore per day; 13,500 tons copper per year. Capacity output: 1955.

Magma Copper Co. Project: Underground copper mine, mill and smelter at San Manuel. Investment: $120-million. Reserves: 367,624,000 tons 0.785% copper (sulphide ore); 111,876,000 tons 0.717% copper (oxide ore). Production rate: 30,000 tons ore per day; 70,000 tons copper per year. Capacity output: 1957.

Miami Copper Co. Project: Open-pit copper mine and plant at Copper



DU PONT CD* BLASTING MACHINES

*CD—Condenser Discharge

ELIMINATE SHOOTING LINES IN POTASH MINE

In extensive mining operations at Carlsbad, New Mexico, the U. S. Potash Company has used Du Pont Condenser Discharge Blasting Machines since they were introduced. They are now using six of these machines and, during the past two years, over 1,100,000 holes have been fired with Du Pont CD Blasting Machines. Elimination of the need for stringing and maintaining shooting lines throughout the mine has proved an important economy.

Work face in U. S. Potash mine . . . undercut, drilled, loaded and ready for firing.

Shift boss in the mine about to fire a blast with a Du Pont Condenser Discharge Blasting Machine.

Muck pile after typical blast. Du Pont "MS" Delay Electric Blasting Caps produced excellent fragmentation.

Du Pont Condenser Discharge Blasting Machines are now available in four sizes: CD-12, CD-24, CD-32 and CD-48. Their capacities range from 20 caps in straight series to 1,200 in parallel series. They fill the need for a lightweight, portable source of power and eliminate costly permanent shooting lines.

All CD Blasting Machines are characterized by (1) extremely high capacity for their weight and size, (2) absence of moving parts, (3) elimination of the human element of mechanical-type machines, (4) a test pilot light, and (5) a wiring and switching system with important safety features.

The Du Pont Explosives representative in your district will gladly give you complete information about CD Blasting Machines and explain how they may serve your own specific blasting requirements. E. I. du Pont de Nemours & Co. (Inc.), Explosives Department, Wilmington 98, Delaware.

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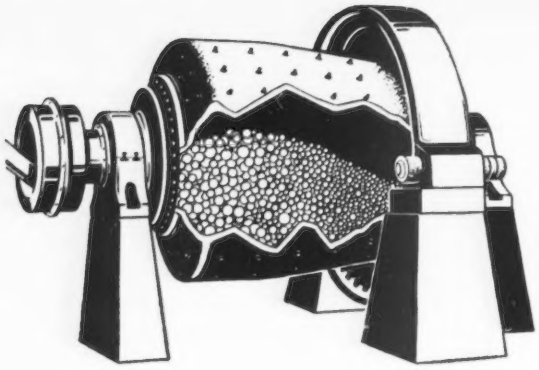


TRICONE MILLS

The **Hardinge** Tricone Mill is ideal for large tonnages because of its design. The tapered barrel causes correct ball alignment, conserving grinding energy. The Tricone Mill occupies less floor space for a given grinding volume than any other mill ever built and overall power consumption is reduced 5% by new design bearings. A grate may be added when more capacity is required but the wear of balls is minimized because only small balls come in contact with the grate. Bulletin AH-414-1.

Four 11'-diameter Hardinge Tricone Mills at Barvue Mines, Ltd., Barraute, Quebec, grinding more than 5000 tons of zinc ore daily.

HARDINGE

Arizona *(Continued)*

Cities. Investment: $16-million. Reserves: 33-million tons —1.0% copper. Production rate: 10,000 tons ore per day; 22,500 tons copper per year. Capacity output: 1954.

Miami Copper Co. Project: Underground copper mine at Miami Extension. Investment: $3-million. Reserves: 23-million tons 0.5% copper. Production rate: 10,000 tons ore per day; 11,500 tons copper per year. Capacity output: 1955.

Phelps Dodge Corp. Project: Open-pit copper mine and plant called Lavender Pit. Investment: $25-million. Reserves: 41-million tons 1.14% copper; 31-million 0.42% copper (leaching). Production rate: 12,000 tons ore per day; 38,000 tons copper per year. Capacity output: 1955.

Manganese Mining. By the end of 1953, an estimated $6-million worth of ore will be stockpiled at Wendon. State employment has been increased by 500 as a result of the manganese program.

American Copper Co. Project: Exploration for new orebodies on 17 claims of old Sunset Mine near Superior. Plans call for the unwatering of a 600-ft. shaft and sinking an additional 300 ft.

COLORADO

Climax Molybdenum Co. Project: Expansion of mine production and mill capacity. Cost: More than $15-million. Capacity: Production capacity increased from 15,000 to 20,000 tons per day. Progress: About $13.5-million of the $15-million were expended by the end of 1952. Storke level development work is well along. Cost to end of 1952 has been $2.7-million, and a similar amount will be expended to complete development of ore from this level. About $700,000 is being spent to develop the Phillipson level this year.

Vanadium Corp. of America: Mining and milling properties in the Colorado Plateau area are undergoing steady expansion. A new roaster is under construction at Durango, and negotiations are under way with the AEC to increase milling capacity at White Canyon, Utah.

Golden Cycle Corp. Project: Improvements at Carlton Mill. Progress: Tonnage handled during 1952 was 50% greater than in 1951. A 600-hp. motor was installed on the rod mill to increase capacity by 25%. Flotation capacity was increased by addition of a four-cell Fagergren flotation unit.

IDAHO

Vulcan Silver-Lead Corp. Project: Deep-level exploration of the Galena mine. Progress: Project started in

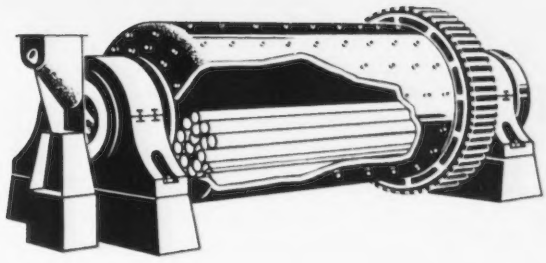
1947. Shaft sunk to 3,000 ft. in 1950. Development work continuing. Surface plant: Includes 5,000-cfm compressor, 900-hp. hoist, 175-ton mill at present. Orebody: Exploration work has exposed a mineralized zone with several lead-silver veins in commercial amounts, and a silver-copper siderite vein averaging 5-ft. wide over 600 ft. assaying about 35 oz. silver per ton. Cost of project: Over $2.5-million has been expended to date. Property is owned by Vulcan Silver-Lead Corp. AS&R and Day Mines are developing the project under lease.

Atlas Mining Co. Project: Deep level exploration of an ore structure with promising showings on the surface and the 800 level. Progress: Project started May, 1951. Surface plant constructed including compressors, new 400-hp. hoist, and ventilation system. Shaft has been deepened to the 2400 level. Crosscutting now in progress on 2400 level. Cost of project: Estimated to be more than $1-million. Hecla Mining Co. sank the Atlas in the early 1940's and found encouraging showings. It then interested Newmont Mining Corp. and New Jersey Zinc Co. in further deep level exploration. Adjoining properties were then acquired through purchase and operating agreements. Atlas participation area now covers some 450 claims in the "East Silver Belt," extending some 10 miles in an east-west direction.

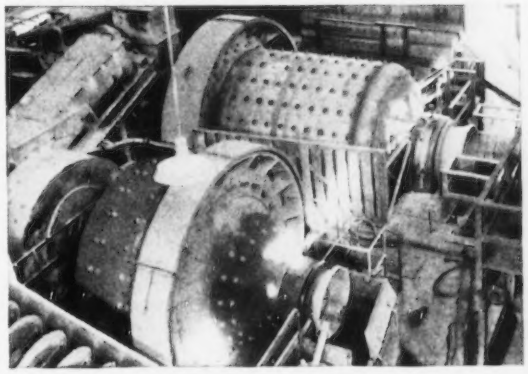
New Purim Project. Objectives: Exploration of the westerly extension of the big shear zone in which Silver Summit's silver-copper orebodies occur. Silver Summit's 3,000 level is to be extended into the New Purim area for a minimum distance of 1400 ft. from which point crosscutting, raising and diamond drilling will be started if warranted. Progress: Project started May, 1952. Silver Summit drift has been advanced over 500 ft. into the New Purim area, and has opened two shoots of commercial silver-copper ore, one 94 ft. long and another 63 ft. long, along the footwall of the shear zone. Diamond drill holes are being put in at intervals. Polaris has a 34% interest, Hayden Hill a 36% interest and Lincoln Mining a 30% interest in this project. Silver Dollar's interest derives from its long-term lease on Lincoln and Hayden Hill properties.

Polaris-Coeur d'Alene Mines Project. Objective: Deep-level exploration of the West Silver Belt between Silver Summit and Vulcan Silver-Lead mines. Participating companies: Polaris Mining Co., Coeur d'Alene Mines Corp., American Silver Mining Co., Silver Standard Mining Co., Rainbow Mining Co., Callahan Consolidated Mines, Inc., Coeur d'Alene Consolidated Silver Mines, Inc., and Merger Mines Corp. Progress: Initial work awaits approval by all participating companies. Cost of the project: Estimated to be $675,000.

(Continued on page 200)



CONVEX-HEAD
ROD MILLS



Lead-zinc concentrating plant of Consolidated Mining and Smelting Company of Canada. Shown here is the largest Rod Mill in existence, a Hardinge 11½' unit. Also one of ten 10' x 48" Hardinge Conical Mills, in the foreground.

The **Hardinge** Convex-Head Rod Mill is ideal for producing minimum oversize when grinding in open circuit. Pulp level may be changed from high to low for best grinding efficiency and discharge may be made through the periphery (end or center) or discharge trunnion. This mill maintains perfect end alignment of the rods, preventing undue head wear, eliminates congestion at the feed end, and provides a rough classifying action at the discharge end. Bulletin 25-C-1.

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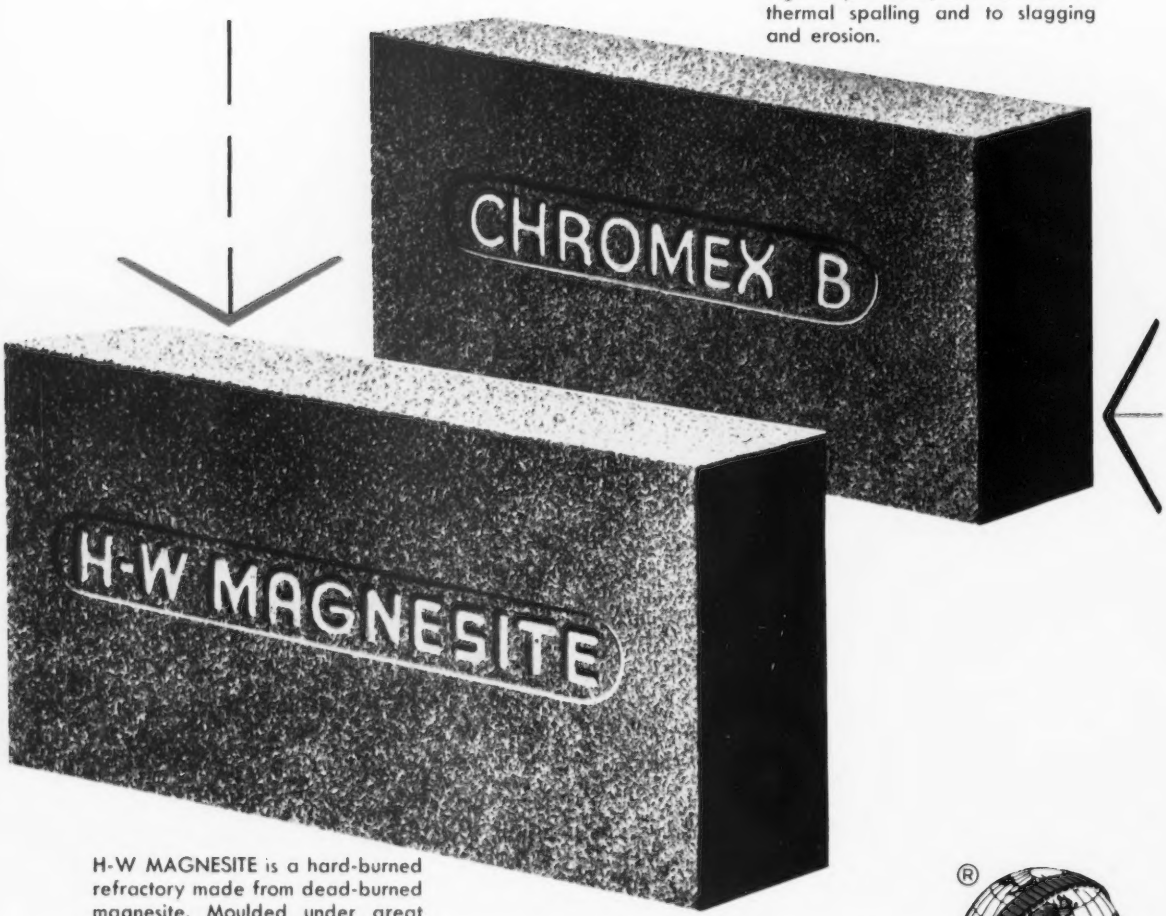

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RC 129

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Idaho *(Continued)*

Bunker Hill & Sullivan Mining and Concentrating Co. Project: Deep-level exploration at the Crescent mine. Progress: Project started October, 1952. Mine camp has been rehabilitated, shaft and workings unwatered. Shaft sinking now in progress. Cost of project: Estimated to be $1,098,750.

Sullivan Mining Co. Project: Improvement of zinc plant and construction of sulphuric acid plant. Progress: Construction of storage bins for blending concentrates largely completed. Construction of pre-treatment plant to remove lime and magnesia well advanced. Installation of the first of four suspension-type roasters which will replace eight present wedge-type roasters, now in progress. Concrete for acid plant largely completed. Cost: About $5-million. Completion date: January, 1954. Acid plant was designed by Leonard Construction Co. and engineered by Singmaster and Breyer. Monsanto process will be used to convert SO_2 to SO_3 with vanadium catalysts.

MICHIGAN

Calumet & Hecla Co. Project: Underground copper mine at Osceola. Investment: $6.5-million. Production rate: 3,000 tons ore per day; 7,000 tons copper per year. Capacity output: 1954.

White Pine Copper Co. Project: Underground copper mine, mill and smelter at White Pine. Investment: $70-million. Reserves: 309-million tons +1.10% copper. Production rate: 12,500 tons ore per day; 35,000 tons copper per year. Capacity output: 1955.

MINNESOTA

Many projects have been under way on the Mesabi to improve recovery by beneficiation or otherwise add to output. Three are cited for Cleveland-Cliffs Iron Co. Addition to the 400-ton Heavy-Media plant at the Hill Trumbull that treats +¼-in. material of a 2-circuit DSM cyclone plant for concentrating the −¼-in. +65-mesh fraction in the feed (spirals treat the −65-mesh material); addition of another section to the Heavy-Media plant at the Hawkins, as well as a 2-circuit DSM cyclone plant like the Hill Trumbull's; and, third, provision of hydrosizers and spirals in a plant at Canisteo mine for treating fines from the tailings pond and classifier overflow from the washer. Increased facilities for research into beneficiation of low-grade ores have been provided also.

U. S. Steel's Oliver division is working on a project to erect eventually a

(Continued on page 204)

DOW

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DOW'S quality frothing agent raises concentrate grade—increases recovery—with reduced frother consumption!

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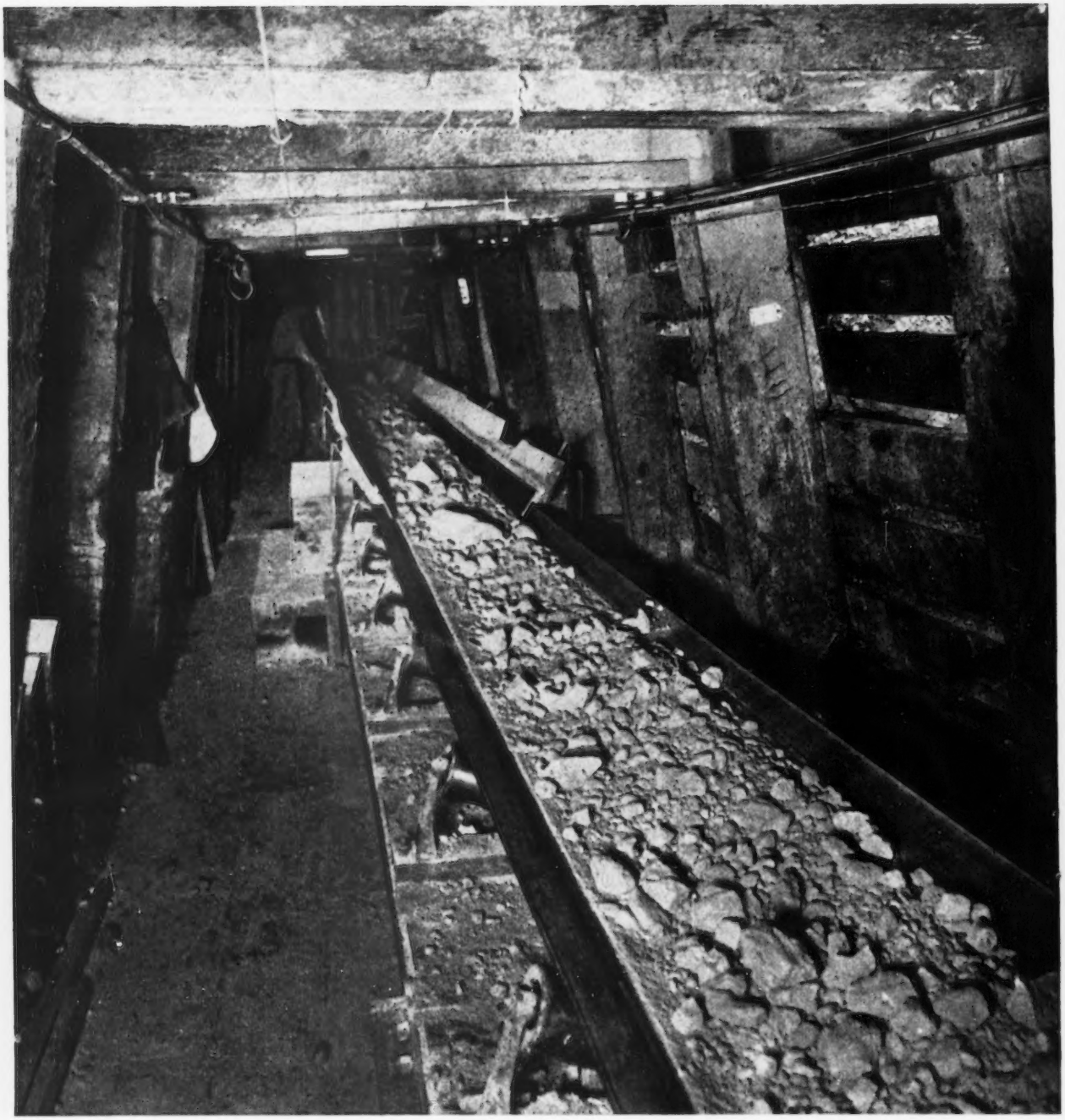

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Whenever you handle ore in bulk—underground, overland, in open pit or mill—Hewitt-Robins belt conveyor systems will provide the most efficient, most economical answer.

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ENGINEERING DATA

FOR BLOCK CAVING: Hewitt-Robins sectionalized ore mine conveyors maintain a steady flow of ore in haulage drift or sub-drift under grizzly level . . . eliminate down time for timber repairs and replacement . . . assure less chance of breaking in stopes or arching in the chutes . . . provide faster withdrawal of block being mined.

FOR UNDERGROUND HAULAGE: Hewitt-Robins sectionalized ore mine conveyors and mine-type shuttle conveyors provide continuous transportation from working face to points of beneficiation. The mine-type shuttle conveyor answers the problem of truly continuous mining . . . it follows the working face and at the same time maintains a fixed transfer point through a fixed tripper—unit is extendable or retractable up to 600' . . . Sectionalized ore mine conveyors for main and stope haulage are available in 8' and 12' sections suitable for 3' and 4' idler spacing with choice of 24", 26", 30", 36", 42" and 48" belt widths.

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Minnesota *(Continued)*

plant at Two Harbors for screening out fines from Mesabi shipments and sintering them before sending these ores down the lakes. Plant site will be near D.M.&I.R. docks. DPA has issued a certificate of necessity for accelerated amortization of 65% of the $60 million required for the project.

Oliver will also build a crushing, screening and washing plant at its Plummer mine now under development at Taconite, Minn. Shipments will start next year.

An 80-tph DSM cyclone plant, built by Western Knapp, will be added to the 175-tph Mobil Mill at the Virginia mine on the Cuyuna by Zontelli Bros. to treat the −¼-in. plus 65 mesh fraction.

A Heavy Media separation and cyclone plant of 350 tph capacity with facilities for crushing, screening and washing is to be built by Pickands Mather & Co. at its Mahnomen mine on the Cuyuna. Shipments will start in 1954.

Westward extension of mining on the Mesabi Range proceeds. Pickands, Mather are expected to begin stripping and developing the Tioga Nos. 1 and 2 leases for Western Mining Co. this summer, and possibly build a plant.

(See additional Minnesota news at close of U. S. section.)

NEW JERSEY

New Jersey Zinc Co.'s Sterling mine in Ogdensburg has been undergoing a major development program for the past few years.

Principal phase of the program was the raising of a new inclined shaft which has been completed to the 1,850 ft. level. Equipping the shaft with rail, sets and ladderway is now complete to the 1,600 level. Permanent power and compressed air lines remain to be installed. Later this year it is planned to sink the shaft to the 2,060 ft. level. Two primary 30 in. x 42 in. jaw crushers will be placed underground, one to crush ore produced above the 1,000 ft. level, the other will be placed below the 1,850 ft. level.

The hoist house building has been erected and work on the installation of equipment is completed. Ore and man hoists are now employed for construction work throughout the shaft. Operation of four new 2,400-cfm air compressors and interior switch gear installed in the hoist house await completion of the shaft. A service tunnel for power and compressed air lines has been built to connect the hoist house with the collar of the shaft. A transformer substation has been completed along with a new power line from the local power company which carries electric power at 33,000 v.

The new North Shaft project is essentially completed. This interior

shaft extends from the 1,850 level to about the 2,700 ft. level. This shaft is 8 ft. x 18 ft. in cross-section containing three compartments — two for hoisting, one for pipe and manway. Seven levels are turned off from the shaft at one hundred foot vertical intervals. The 2,550 ft. level will be the lowest level, with skip-loading pockets below. Auxiliary ore pass, fill pass, and ventilation-ladderway raises are completed. Level development preparatory to stoping is completed through the 2,150 level. Additional deadwork on the lower levels will be accomplished as needed when additional stopes are brought into production. Installation of a new 40,000-cfm fan on the 1,750 level is underway to ventilate this lower north section of the mine.

MONTANA

Anaconda Copper Mining Co. Project: Greater Butte underground copper mine and mill. Investment: $29.3-million. Reserves: 130-million tons + 1.0% copper. Production rate: 15,000 tons ore per day; 45,000 tons copper per year. Capacity output: 1954.

Minerals Engineering Co. Project: Mill to treat tungsten ores in the Dillon-Melrose area. Product: Tungsten concentrates. Ore treated: Low-grade scheelite and powellite ore. Investment: $225,000. Flotation will probably be used in mill. Concentrates will be shipped to Salt Lake City for further treatment.

American Chrome Co. Project: Re-equipment of 1,000-ton mill and mine to treat chrome ores. Product: Chrome concentrates. Investment: $4.4-million. Ore: Chromite and spinel, averaging about 18% Cr_2O_3. Capacity output; Late summer 1953. American Chrome is controlled by Goldfield Consolidated Mines Co., Reno, Nev. Company has contract with Government to produce 900,000 tons of chrome concentrates from 1953 to 1961. Concentrates must contain at least 38% Cr_2O_3, on which base price will be $34.97 per ton.

NEVADA

Anaconda Copper Mining Co. Project: Open-pit copper mine and leaching plant at Yerington. Investment: $38-million. Reserves: 35-million tons + 1.0% oxide ore. Production rate: 11,000 tons ore per day; 33,000 tons copper per year. Capacity output: 1954.

Kennecott Copper Corp. Projects: Deep Ruth and Kimbly Pit underground copper mines. Investment: $14-million. Reserves: 25-million tons —1.0% and 3.5-million tons —1.0%, respectively. Production rates: 8,000 and 4,500 tons ore per day; 18,000 and 9,000 tons copper per year, re-

- Vacuum and Pressure Filter Element Covers
- Dust Collector Tubes, Bags and Envelopes
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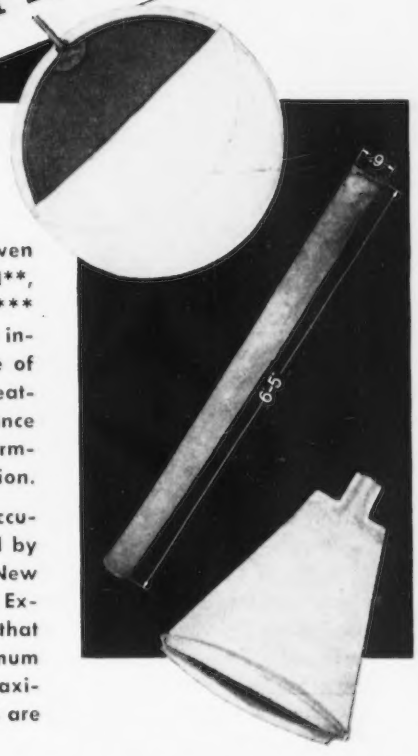
Let US make up your Element Coverings from NFM Filter Media



NFM Filter Media are woven from Nylon, Orlon*, Vinyon N**, Saran, Glass, Dynel, Vincel*** and Cotton. This wide range insures your obtaining the type of element covering having the greatest degree of chemical resistance and best general all round performance for your particular operation.

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Nevada *(Continued)*

spectively. Capacity output: 1954.

Nevada Panacalite Inc. Project: Perlite plant at Henderson. Capacity: 100 bags per hr. The company uses crushed and processed ore from Combined Metals Co. at Pioche.

Bruhi Enterprises. Project: Development of Argentine Development group in Silver Peak area. Plans call for drifting a total of 1,300 ft. to adjacent Mohawk boundary. A new bunkhouse and office building have been constructed.

Manganese Inc. Project: Manganese concentrator. Capacity: 1,200 tons of ore daily from the Three Kids mine. Cost: $2.5-million. The new plant is treating ore from the Three Kids mine by a new flotation process.

Combined Metals Reduction Co. Project: New concentrator for Pioche Manganese Co., controlled by Combined Metals. Cost: $3-million. Progress: Concentrator has just been completed.

Eureka Corp., Ltd. Project: Unwatering the Fad shaft. Cost: $3-million, aided by a $750,000 Federal loan. Water is being pumped from the 2,350 ft. level.

OREGON

Hanna Nickel Smelting Co. Project: Nickel smelter at Riddle, Ore. Investment: $24.8-million, maximum DMPA advance. Product: Ferronickel. Production: DMPA contract as per mining-smelting agreement whereby DMPA purchases ore from Hanna Coal & Ore Corp. and resells to Hanna Nickel Smelting Co. at purchase price. Agreement calls for ferronickel ingots of 25% nickel and not more than 75% iron, minimum 95-million lb. nickel, by June 30, 1962.

Special floor price: 79.39¢ per lb. first 5-million lb. nickel, 60.5¢ per lb. thereafter. Technical facts: Smelting process adaptation of French Societe d'Ugine under royalty agreement, according to Oregon Department Geology & Mineral Industries. Financing: DMPA has agreed to advance funds for smelter and related facilities under construction.

Hanna Coal & Ore Corp. Project: Mine at Nickel Mountain, Ore. Investment: $4.3-million. Product: Nickel silicate ore. Grade of ore: 1-3% nickel. Production: DMPA contract calls for minimum of 95-million lb., maximum of 124-million lb. nickel by June 30, 1962. Special floor prices of ore: $6 per dry ton of 1.5% nickel. Technical facts: Ore will be bench mined from ridge of Nickel Mountain in Douglas County, near Riddle, Ore. Mining slated to get underway to meet smelter construction program at Riddle, Ore.

(Continued on page 210)

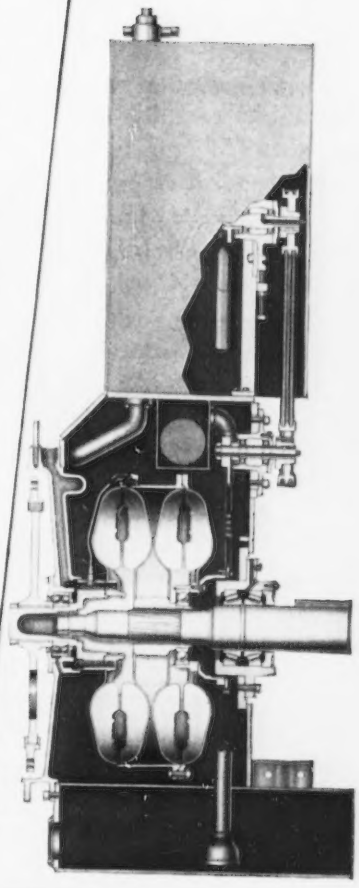
NEW Model HUD Disconnecting Hydraulic Power Take-Off . . .

Reduces Impact Shocks 70%

Doubling wear life on chains, clutches and running parts, drilling rigs equipped with the new Twin Disc Disconnecting Hydraulic Power Take-Offs have been running up outstanding service records during the past two years. Many rigs now drill deeper, more economically, because the new Twin Disc Model HUD allows the *full use of peak engine torque* . . . dampens starting shocks, stopping shocks and overloads. Through the complete Disconnect feature, the HUD acts as a master clutch.

Steady power transmission through Twin Disc HUD softens and controls speeds of acceleration and deceleration . . . to reduce impact shock—on power units *and* driven equipment—by 70% or more. Compounded drives can easily be synchronized—drum clutches can safely be engaged with engines idling, for smoother load pick-up—the range of available mud pump speeds and pressures can be greatly extended. Rig engines, free to run at their most efficient rpm, *prevented* from lugging or stalling under load, are assured of a longer, more serviceable, trouble-free life.

For complete information on how Twin Disc Disconnecting Hydraulic Power Take-Offs are adding efficiency to modern drilling rigs, contact your nearest Twin Disc Factory Branch, or write to the Hydraulic Division, Rockford, Ill.



Twin Disc Model HUD Disconnecting Hydraulic Power Take-Off—available in coupling sizes 21" and 27"; to handle 60 to 600 hp engines . . . operates with either cooling radiator or heat exchanger . . . incorporates shortened oil sump to fit rig design.

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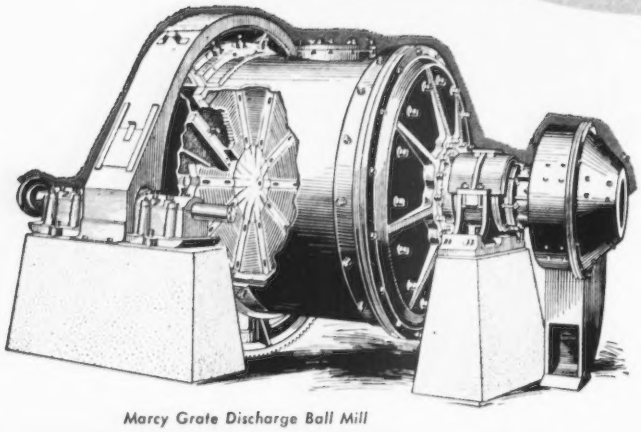
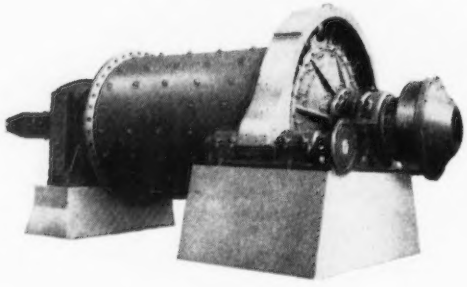


Marcy Grate Discharge Ball Mill

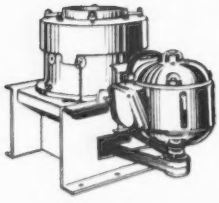
For Wet or Dry Grinding of ore, cement, clay or fibrous materials. Types, sizes and capacities for from 5 tons up to 3000 tons per 24 hours. Marcy Grate Discharge Ball Mills and Open End Rod Mills have unique features resulting in quick discharge, maximum useful grinding, minimum overgrinding and better metallurgy. Used throughout the world.



Marcy Open End Rod Mill

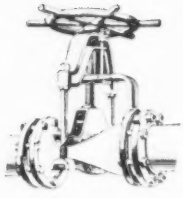
Massco Gy-roll Reduction Laboratory Crusher

Reduces ½" feed to as fine as 10 mesh in single pass. High capacity with low power consumption. 6" and 10" sizes.



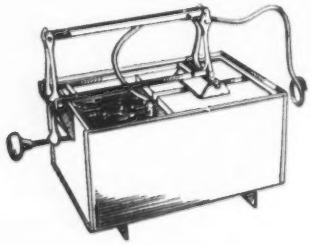
Massco-Grigsby Rubber Pinch Valves

Designed for abrasive and corrosive pulps. Patented hinged sleeve for longer wear. 1" to 12" diameter. Up to 150 pounds continuous pressure.



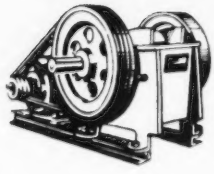
Massco-Adams Reagent Feeders

For wet reagents and other liquids. No mechanically driven moving parts. Only one micrometer screw adjustment. Siphon principle. Requires no electrical connections.



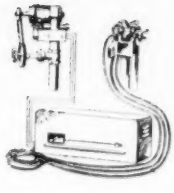
Massco Laboratory Jaw Crusher

Welded steel frame; manganese steel jaw and check plates; bronze bushed bearings; smooth jaws give better product and easier cleaning. Adjust for plate wear by convenient hand wheel adjustment.



Massco-Adams Density Controller

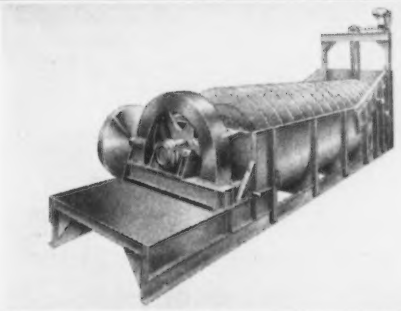
Automatically regulates water dilution of pulp in grinding circuit to maintain constant percent solids—thus, controls size of finished product.



cost-cutting equipment

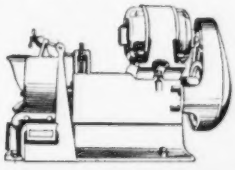
Akins Classifiers and HMS Separators

Akins Classifiers are made in sizes from 12" to 84" dia., simplex and duplex. They are used for classification of solids by size, dewatering, washing coal, preparation of china clay and glass sand, desliming and de-oiling phosphate rock, sink-float concentration. Used throughout the world by hundreds of the best companies in the mining and process industries.



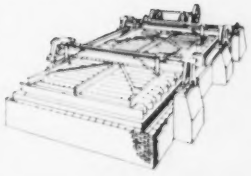
Massco-McCool Pulverizers

Disc type grinder with planetary movement. No gears. Will grind to 150 mesh in one pass.



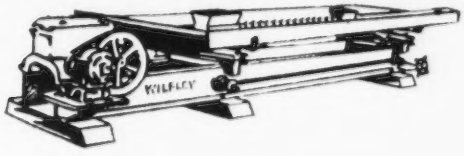
Lowden Dryer

For drying flotation concentrates, graphite, clays, ground minerals, paint fillers, pigments, various precipitates. Can use most any fuel including live steam and waste heat.



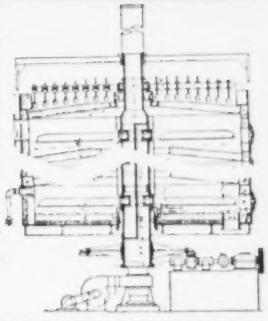
Wilfley Tables

For separation of any ore or material amenable to gravity concentration. Laboratory and commercial sizes—up to 180 tons capacity per 24 hours.



Skinner Roasters

For roasting and calcining ores, clays, limestone, limestone mud; decomposing oil sludge in process of producing sulphuric acid; incinerating sewage and garbage. Coal, oil or gas fired. Sizes to 22' inside diameter; up to 12 hearths.



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Denver 2, Colorado

OFFICES IN SALT LAKE CITY, EL PASO, 1775 BROADWAY, N. Y. C.

1. Orinoco Mining Company's new ore and cargo handling dock on the Orinoco River, Venezuela. Composed of 3 units, this DeLong dock is 1,130 ft. long, 82 ft. wide, and 15 ft. deep.

DeLong AIRJACK TRANSFORMS SEA-GOING DOCK-BARGE INTO ORE AND CARGO PIER!

Cuts time, costs!

Field work is practically eliminated in dock construction, due to the development of the patented DeLong Airjack. This new technique of dock construction speeds installation, cuts costs.

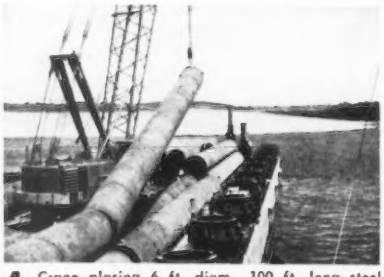
The DeLong Airjacks, which are the key to the whole transformation of barge to pier, enable the dock to "climb" the steel columns, or caissons, to required elevation. After the self-lifting operation, caissons are driven to refusal for permanent installations. Caissons are welded to deck and cut off flush; then filled with concrete or sand and tops closed with welded cover plate.

More than ½ million sq. ft. of the DeLong type of pier are in use or under construction in diversified locations that range from the Arctic to South America.

The DeLong Airjack can cut time and costs in the construction of offshore oil well drilling platforms, portable and permanent piers, and many other types of installations. A DeLong dock can be erected and, after having served its purpose, jacked back to water level and towed to a new location.

2. A week after arrival at Orinoco River site, first dock section 376 ft. long berths ship, and unloading begins. Two additional units make this pier 1,130 ft. long.

3. Loaded dock section, fabricated at an Orange Texas yard, arriving at site on Orinoco River, after being towed across 3,000 miles of ocean. Dock carried caissons, crane, Airjacks, compressors, generators, other installation gear.



4. Crane placing 6 ft. diam., 100 ft. long steel caissons in wells fitted with Airjacks. Crane, Airjacks and other equipment were later transferred to second and third sections for erection purposes.

5. Caissons held in position by Airjacks until dock barge is jockeyed into final position. Caissons are then dropped to river bottom and DeLong Airjacks lift dock to final elevation. Control is so precise, height of dock can be regulated to 1/32 of an inch.

DeLong
Engineering & Construction Co.
29 BROADWAY, NEW YORK 6, N. Y.
Phone: HAnover 2-1275

WASHINGTON 5, D. C.	SEATTLE, WASH.	CARACAS, VENEZUELA	SAN FELIX, VENEZUELA
729–15th St., N. W.	32nd Floor, Smith Tower	Apartado 968	

Oregon *(Continued)*

Harvey Aluminum, Inc. Project: Aluminum plant at The Dalles, Ore. Investment: $65,250,000. Products: Alumina and aluminum. Production: Plans call for importing bauxite from Surinam in Caribbean via Panama Canal, Pacific and Columbia River deep water channel to The Dalles, Ore. plant site. General Service Administration contract calls for two potlines to be completed by May 1, 1955. Construction has started under initial permits issued May 23 to Mid-State Construction Co., in Harvey's name. Plans call for facilities to process bauxite to alumina and reduction to aluminum. Bonneville Power Administration contract for energy delivery calls for 40,000 kw. firm power by July 1, 1954, and additions of "junior" and interruptible energy, totaling 120,000 kw. in all.

Special floor price: GSA agreement, to be executed by Nov. 24, calls for government to have option to buy all of 54,000 short tons annual capacity for five years at market price and, in turn, GSA agrees to buy at market price any metal offered by the company which it does not sell or use.

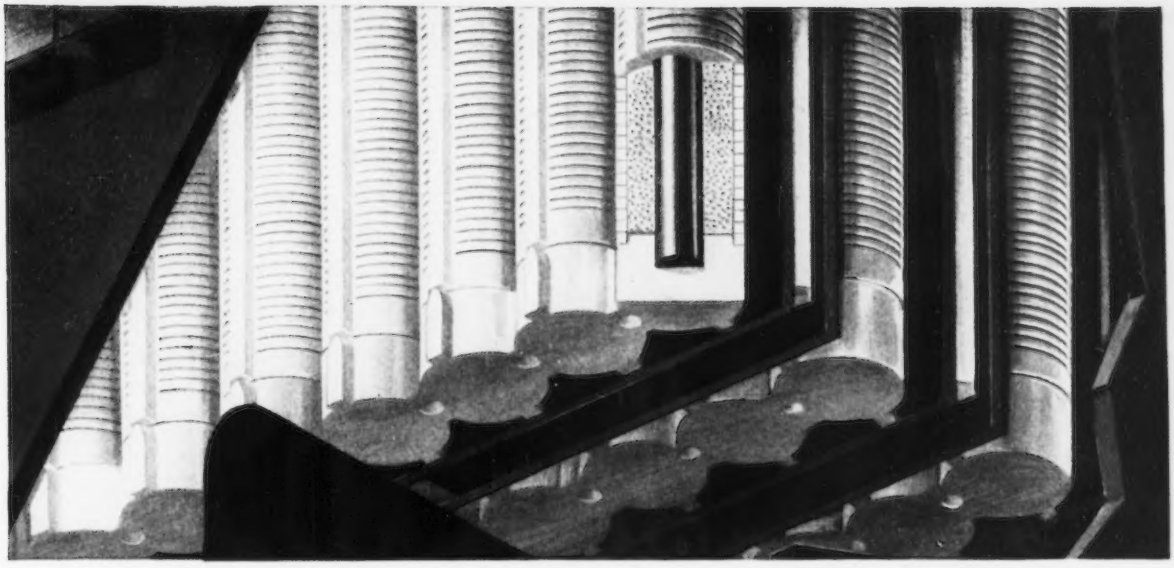
National Metallurgical Corp. Project: Aluminum plant at Springfield, Ore. Investment: $500,000. Product: Aluminum silicon alloy. Production rate: Unannounced.

Company building pilot plant type facilities involving one electro-process smelter to utilize alumina bearing silicate clays available in California, Oregon and Washington. Flash roasting process developed by U. S. Bureau of Mines, Albany, Ore., utilizes wood waste chips—sawdust available from Oregon lumber mills in Springfield area. Experiments at Albany Research Laboratory indicate low-cost wood wastes increase porosity of clays and contribute heat for process and carbon to the product. Construction underway with announced plans to start production Jan. 1954. Site allows expansion for addition of four smelters. Alumina clays available by open-pit quarrying at Hobart Butte, near Springfield, Ore.; Castle Rock, Wash.; and Bishop, Calif. Assays indicate clay contains 35-44% Al_2O_3, 13-23% Fe, 13-20% SiO_2.

UTAH

Minerals Engineering Co. Project: Tungsten refinery capable of working low-grade western ores. Investment: $250,000. Progress: Construction has just commenced on project which initially will: 1) Rework some 30,000 tons of tungsten tailings on property; 2) utilize mill concentrates from a new mill being erected by Minerals Engineering Co. at Glenn, Mont.

Blair Burwell, president, believes refinery can produce tungsten commercially from concentrates of less than 1% values.



For Mine haulage . . . Exide-Ironclad now offers

- ★ **20% more capacity in the same space**
- ★ **Lowest cost per A. H. to own and operate**

These are the features that contribute to the higher capacity and longer life of the T-H Battery:

Its larger positive plates, containing corrosion-resistant Silvium, are different . . . unique . . . exclusive! No other type of positive plate construction offers you the advantages of the T-H Exide-Ironclad, with its slotted plastic tubes, permanently sealed on the bottom with polyethylene tube sealer. More active material is exposed to the electrolyte, resulting in greater power. More active material is retained, providing higher battery capacity for a longer working life.

Other features include improved negative plates . . . practically indestructible Pormax separators . . . new sealing compound . . . shock-proof molded jar . . . unbreakable quarter-turn vent plugs of plastic . . . corrosion-resistant tray coating.

Now-more than ever before...
YOUR BEST POWER BUY AT ANY PRICE!

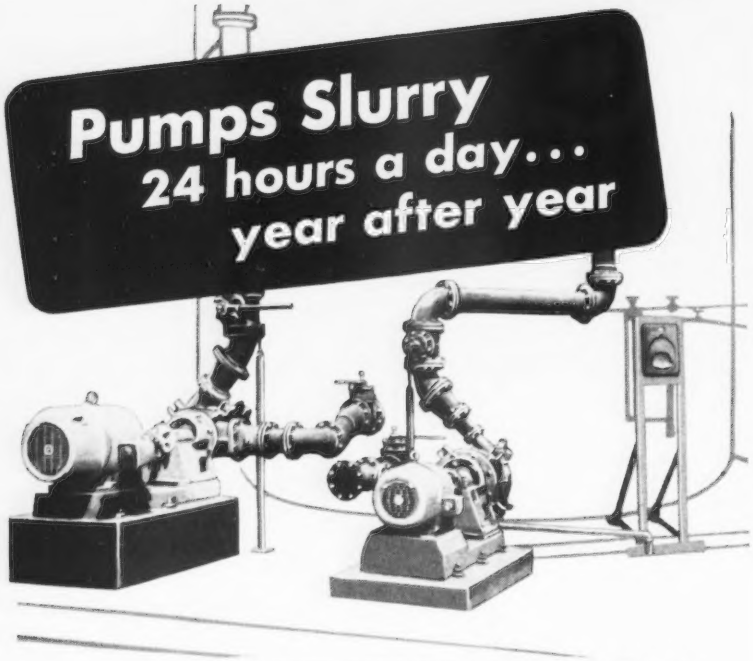
1888 . . . DEPENDABLE BATTERIES FOR 65 YEARS . . . 1953

The new T-H Exide-Ironclad BATTERY

Thrifty Hauler

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 2 • *Exide Batteries of Canada, Limited, Toronto*

"EXIDE", "EXIDE-IRONCLAD", "SILVIUM", "PORMAX", *Reg. T.M. U.S. Pat. Off.*



● MORRIS TYPE R SLURRY PUMP at the left is on continuous 24-hr. duty delivering 1000 GPM of a 170° lime slurry at 100′ head. Fifty-HP motor operates at 1180 RPM. Intermittent-duty pump at right delivers 200 GPM at 50′ head with 7½-HP motor turning at 880 RPM.

In slurry-handling operations, "long-term service" is a meaningless claim unless the pump will work day-in and day-out with a minimum of maintenance time, trouble and expense

Morris Type R Slurry Pumps—with an established reputation for longer life—also incorporate in their design exclusive features which result in easier installation . . . fewer interruptions to service...less overhaul...fewer replacements.

To provide uninterrupted service . . .

The gland is under suction pressure only. This reduces leakage and dilution . . . keeps harsh abrasives out of the stuffing box . . . practically eliminates packing troubles.

There are no internal studs or bolts. Caustic and corrosive solutions cannot seep past threads and cause maintenance headaches.

To make installation and dismantling easy . . .

Shell is interchangeable for right or left hand rotation. Suction and discharge nozzles can be rotated around the axis of the pump to a total of 72 different locations.

Impeller removed without disturbing the piping. You simply loosen 4 *outside* clamping bolts and pull off the end cover. This feature alone saves considerable time and labor.

● *Free Service.* Morris Engineers will be glad to recommend the pump best suited to your needs for size, capacity, etc. Send necessary data today . . . include request for Bulletin 181.

MORRIS MACHINE WORKS
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MORRIS *Centrifugal Pumps*

Utah *(Continued)*

H & M S Milling Co., same address, will work in conjunction with Minerals Engineering and will shortly publish ore-buying contracts for Utah, Idaho, Montana and Nevada tungsten producers.

Western Phosphates Inc. Project: Plant to make treble superphosphates, amophos, phosphoric acid (fertilizer grade) from low-grade phosphatic shales from Leefe, Wyo. Investment: $5-million. Capacity: Will process more than 92,000 tons of these shales annually. Starting date: Third quarter, 1953. Utilizes "wet process," sulfuric acid treatment of phosphate rock to produce phosphoric acid. Rock is then treated with phosphoric acid to create treble superphosphate. Ammonia will be imported either from California or Texas-Gulf area.

San Francisco Chemical Co. is expanding operations in phosphate belt of western Wyoming, southeastern Idaho and northern Utah to meet increased demands of new Western Phosphate plant at Garfield. WP is 50% controlled by Stauffer Chemical Co.; 25% each by American Smelting & Refining Co., Kennecott Copper Corp. through Garfield Chemical & Manufacturing Co.

Howe Sound Co. (Calera Mining Co.). Project: Cobalt and ammonia sulphate plant. Investment: Estimated to be more than $6-million. Process: Products will be extracted from mill concentrates made at Black Bird mine, Cobalt, Ida., by Calera Mining Co. Arsenic type ores. Ammonia sulphate is an important by-product of process.

Progress: Production has been delayed for months. Goal is more than 3.5-million lb. annually of metallic, powdered cobalt.

Firm has shipped 50 tons of cobalt and is running at around one-third capacity when in operation. Officials confidently expect to lick "bugs" which are mechanical in nature. Process developed by Chemical Construction Co. (American Cyanamid Co.) is definitely workable and practical. Said process is a "secret," but it utilizes high pressure, high temperature, stainless steel autoclaves into which concentrate slurry is introduced and apparently oxidized by introduction of air under great pressure. Officials have stopped estimating when "volume production levels" will be attained.

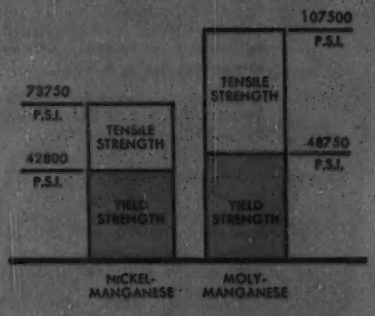
U. S. Smelting, Refining & Mining Co.—Kennecott Copper Corp. Project: Removal of surface facilities from Upper Bingham to Lark for USSR&M by Kennecott Copper Corp. Driving of new Bingham tunnel connecting these surface facilities with main USSR&M workings and replacing old Niagara tunnel. Investment: Estimated to be in excess of $8.5-million.

Utah Construction Co. had contract on both jobs. The new Bingham tunnel is more than 2,350 ft. long. It

(Continued on page 216)

AMSCO V-MANG

The new moly-manganese electrode that's better than nickel-manganese rods for build-up and repair



Comparison of yield and tensile strength

For full engineering and metallurgical information on Amsco V-Mang, write for technical data sheet to Amsco, Chicago Heights, Illinois.

- **TOUGHER DEPOSIT**
- **BETTER WELDABILITY**
- **HIGHER YIELD STRENGTH**
- **LESS CRACKING**

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THE RIGHT WAY TO SAY HARDFACING

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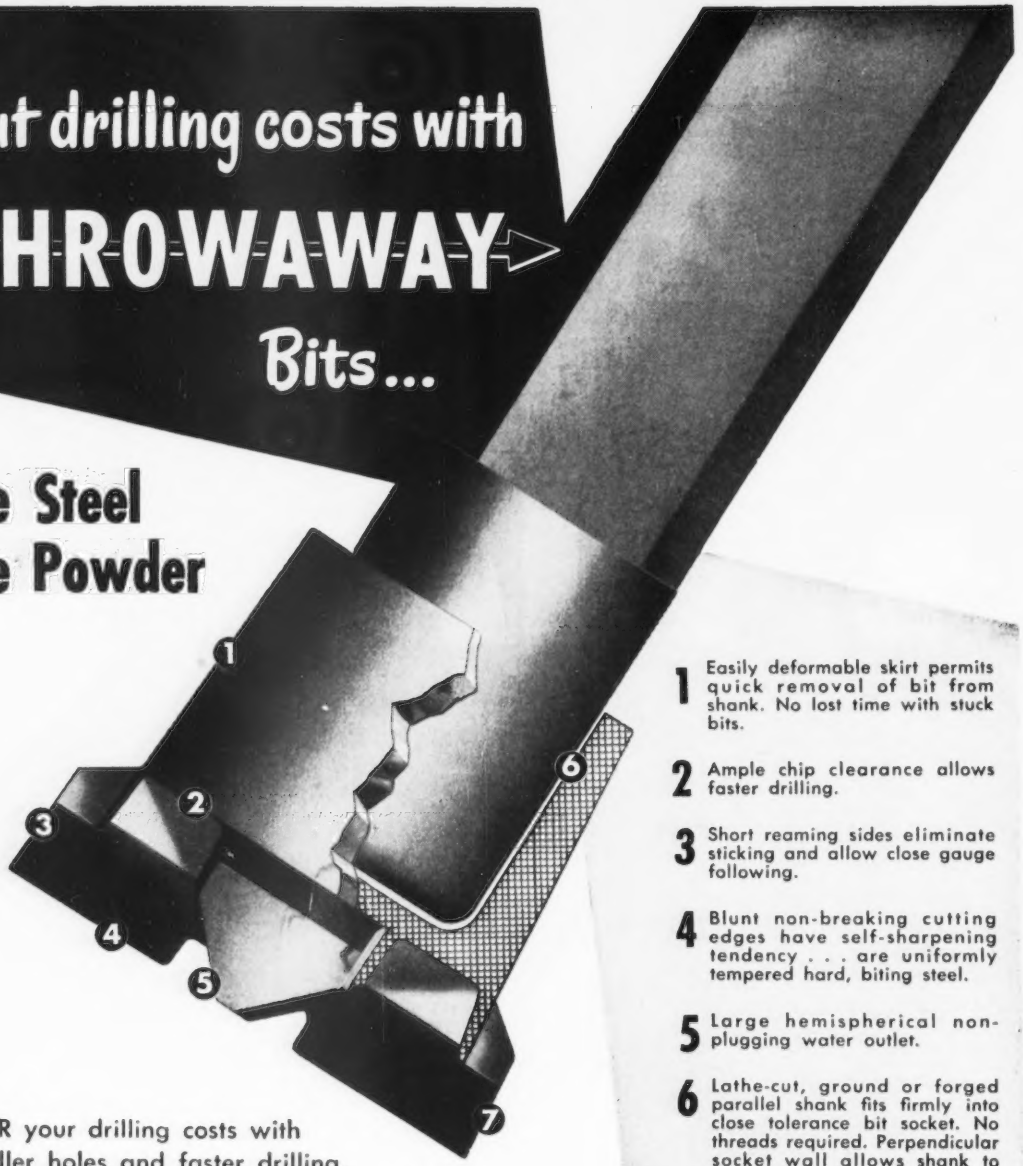
Other Plants: New Castle, Del., Denver, Oakland, Cal., Los Angeles, St. Louis. In Canada: Joliette Steel Division, Joliette, Que.
Amsco Welding Products distributed in Canada by Canadian Liquid Air Co., Ltd.

Cut drilling costs with THROWAWAY Bits...

Save Steel
Save Powder



1 Easily deformable skirt permits quick removal of bit from shank. No lost time with stuck bits.

2 Ample chip clearance allows faster drilling.

3 Short reaming sides eliminate sticking and allow close gauge following.

4 Blunt non-breaking cutting edges have self-sharpening tendency . . . are uniformly tempered hard, biting steel.

5 Large hemispherical non-plugging water outlet.

6 Lathe-cut, ground or forged parallel shank fits firmly into close tolerance bit socket. No threads required. Perpendicular socket wall allows shank to bottom in bit for maximum performance.

7 Perfect uniformly treated bit teeth assure best possible cutting power and smooth operation.

LOWER your drilling costs with smaller holes and faster drilling. Bottom with 1¼ inch holes and save costly steel and powder. Let us prove to you that the man at the drill can do more work for less cost with a Throwaway Bit. Write for new low price list and technical description of Throwaway Bit to: Portland, Oregon home office or distributors listed below. Competent field engineers and dealers are always at your service.

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Cut mill operating expenses to the bone!

Install longer-lasting U·S·S LORAIN ROLLED PLATE LININGS...

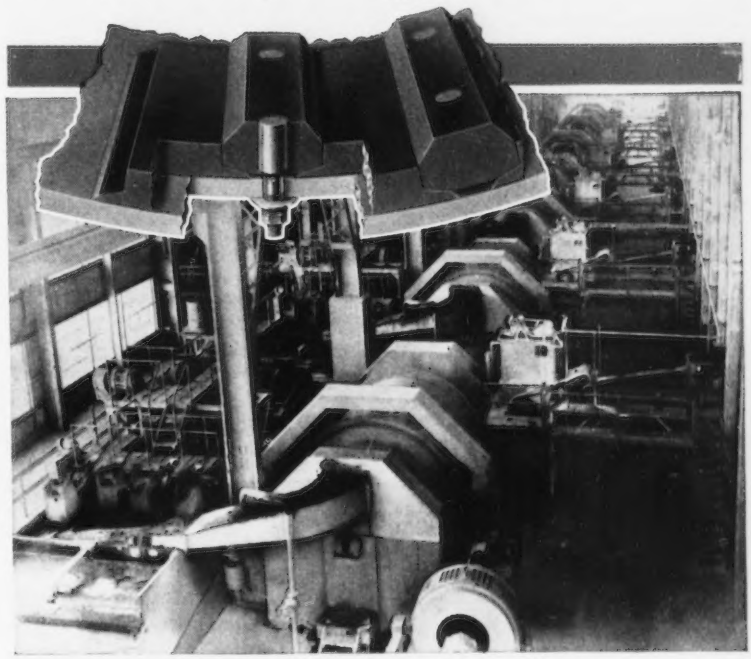
Save on every ton you grind!

NO matter what you grind, U·S·S Lorain Rolled Plate Linings will produce better grinding results, more economically. They're made in easy-to-handle sections that save hours of installation time. They keep mill down-time to a minimum. They're so rugged they'll wear 'til they're paper thin without failing!

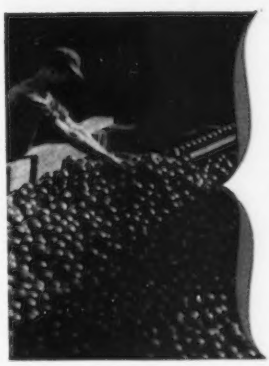
Made from top-grade *rolled steel*, Lorain Linings have far greater wearing life than regular cast linings. Their outstanding strength makes possible the use of thinner sections, saves first cost of metal . . . increases usable diameter of the mill, boosts output. The tight joints between ends of plates and close fit between plates and lift bars eliminate shell wash and allied troubles.

The Liner Plates of Lorain Linings are made symmetrical and interchangeable. Severe localized wear at feed or discharge end can be balanced by heat-treating. The Lift Bars, carefully designed to insure correct cascade action, are available in different lift heights to suit conditions. Lift height will remain approximately constant for life of the lining.

U·S·S Lorain Rolled Plate Linings are available—in the diameter, length and thickness best suited to your operating conditions—through leading mill manufacturers whose names will be furnished upon request.



Installation shows seven Allis-Chalmers' 10½' x 11' Ball Mills.



U·S·S GRINDING BALLS make better, more economical grinding doubly sure. Available in sizes from ¾" to 5" in diameter. For further information just return this coupon.

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Pittsburgh 30, Pa.

Without obligation on my part, please send me your FREE booklet on U·S·S Grinding Balls.

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Company.....

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U·S·S LORAIN ROLLED PLATE LININGS AND U·S·S GRINDING BALLS

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UNITED STATES STEEL

Radio Contact *keeps all construction equipment rolling. Cuts lost time. Saves manpower and money.* Read what it can do for you.

Now . . . RCA 2-way radio

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. . . it can help your business too

Do you operate . . . Field crews?
Trucks, buses, or taxis?
Pipe lines or power lines?
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Materials handling operations?

IF SO, YOU'RE LOSING A LOT if you don't look into RCA 2-way radio. It puts a "phone" in every truck or car. Lets you contact any vehicle in the field *instantly . . . by radio.*

No more aimless driving

Radio directs field forces from job to job. Saves gas and oil, wear and tear. *Saves precious time in emergencies.* Field crews cover area more efficiently. You need fewer trucks, less equipment.

You're always in touch with office

When you're driving in the field, you're still in touch with office and with field men, too. You cut costly phone bills. And you can always be reached if needed.

Easy to install—operate—maintain

RCA helps you set up your 2-way radio system. Includes field survey (usually no charge), help with FCC permit, help with installation. And RCA Service Company handles service and maintenance on contract basis if desired.

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☐ Transportation (Truck, Bus, Taxi, etc.)
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Name _____ Title _____

Company _____

Address _____ City _____ State _____

RCA **RADIO CORPORATION of AMERICA**

Utah *(Continued)*

connects directly with the new change house, office at Lark.

Move is necessitated by development of the big open-pit mine of the Utah Copper Division, which within a few years of normal operations would engulf the old upper Bingham surface facilities, shafts and adit of Niagara tunnel. The tunnel and the erection of the surface facilities for USSR&M have been completed.

CORRECTION

King Lease Still Operating

Despite low metal prices that have forced curtailment of its operations, King Lease, Inc., which runs the Camp Bird Mine near Ouray, Colo., is still employing 46 men and is producing 160 tons of ore daily.

MINNESOTA

(Continued from page 204)

Oliver Iron Mining Co. is moving about 500,000 yd. of taconite following a stripping project at the East Morris mine. The East Morris adjoins the Albany.

Jones & Laughlin Mining Division has installed a scrubber at the Schley mine, Gilbert. The machine weighs 50 tons, and is designed to handle a painty high-alumina ore with 9 to 10% silica. Crude has about 18% moisture and 45% natural iron. Product would be about 50%. Capacity is about 250 to 300 tons per hr., and recovery about 50%. Ore from the scrubber goes over a screen. Oversize goes with coarse concentrates, undersize to screw-type classifier. Silica in the concentrates is reduced about 6%.

Cleveland Cliffs Iron Co. is making the following changes on the Mesabi Range: A new two-unit cyclone installation has been completed at the Hill-Trumbull mine. The cyclones handle a classifier product which was formerly treated by spirals. A similar two-unit cyclone has been installed at the Hawkins mine in addition to a second sink and float unit. These are now in operation.

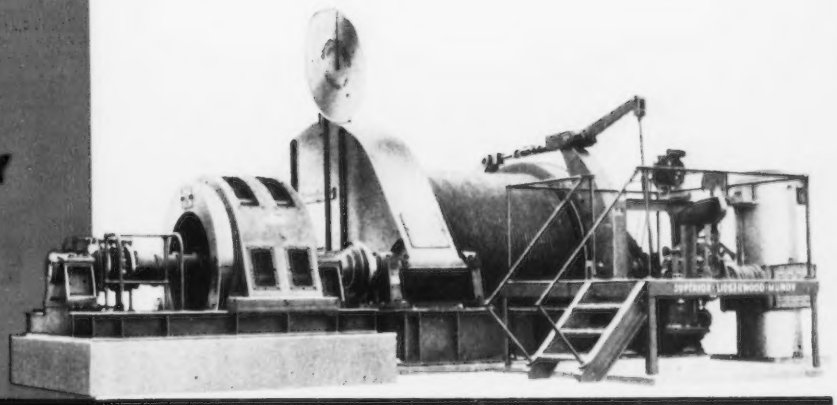
At the MacKillican mine, south of Hawkins, a screening plant has been built in the pit. It started up May 10.

The Canisteo mine at Coleraine is preparing to treat tailings from the old tailings basin with hydrosizers and spirals. Operation has been scheduled to begin July 1.

Rhude-Gilbert Corp. is stripping the Alworth Land Reserve which adjoins the Scranton mine on the west. Mined ore will go to Cleveland-Cliffs Iron Co. which has sub-leased to the Rhude-Gilbert Corp. Stripping will run up to 120 ft., and amount to some 2.2-million cu. yd. The pit area will have about

(Continued on page 220)

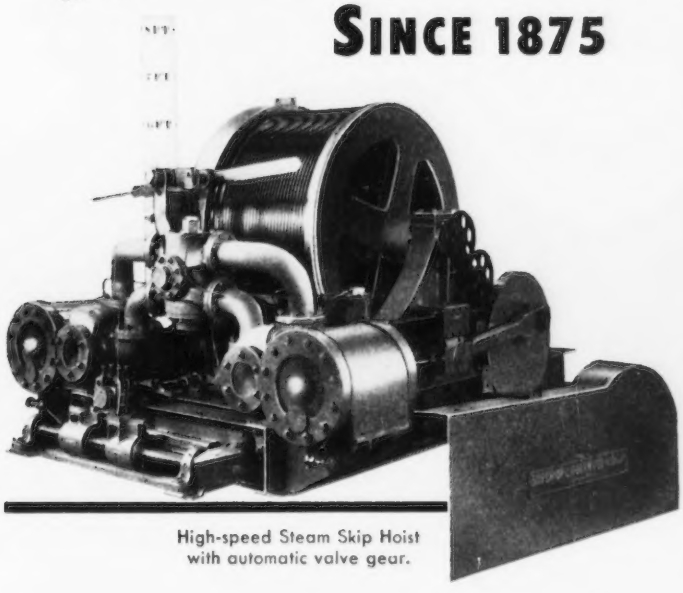
QUALITY HOISTING MACHINERY OF EVERY TYPE



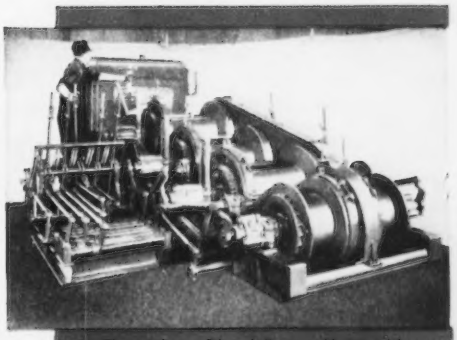
600 HP Electric Mine Slope Hoist.

Built and Designed by **Lidgerwood**

SINCE 1875

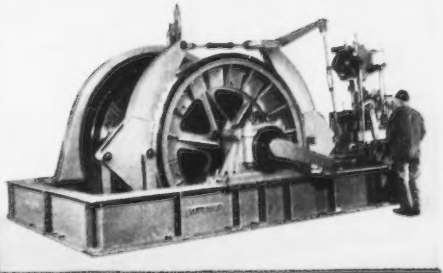


High-speed Steam Skip Hoist with automatic valve gear.



Three-drum Diesel Barge Hoist with Vang Line Drums and banked levers.

High-speed Shaft Hoist for handling cages or dumping skips.

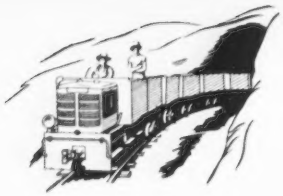


Write for bulletins and catalogs!

We also build Cableways—Every type—Loads up to 150 tons. Electro-Hydraulic Marine Machinery. Special Machinery.

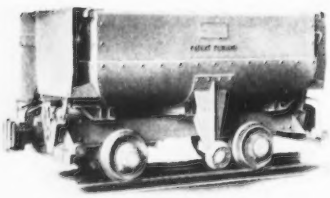
LIDGERWOOD INDUSTRIES, INC.

7 DEY STREET, NEW YORK 7, N. Y.

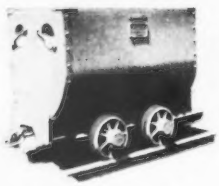


For Mine Operators and Railroad Men with a Specific Problem . . .

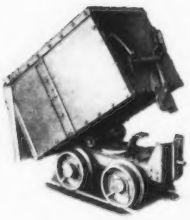
We've got what it takes to get your job done right!



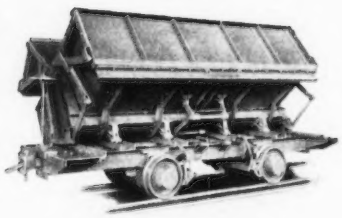
Granby car with rounded corners at bottom, joining ends and side



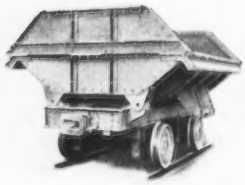
U-Body Mining Tub of 17 to 27 cu. ft. capacity



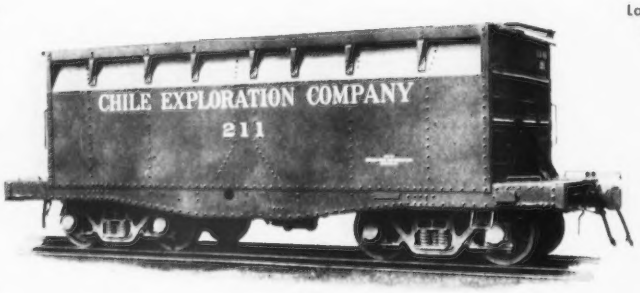
3-Way Dump Ore Mine car mounted on steel turntable.



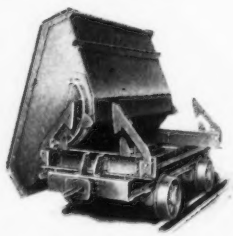
Large capacity Square Box Side Dump car of narrow width and low height.



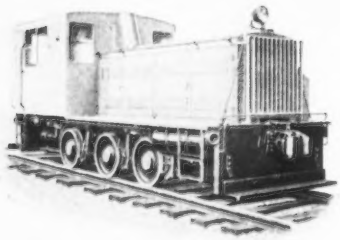
Tray type Dump car, trussed style body end construction with sandwich type floor



140,000 lb. capacity steel Ore car with sandwich type steel and wood floor

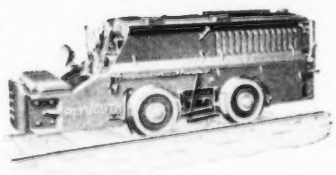


Low Loading Rocker Dump car suitable for hand or shovel loading



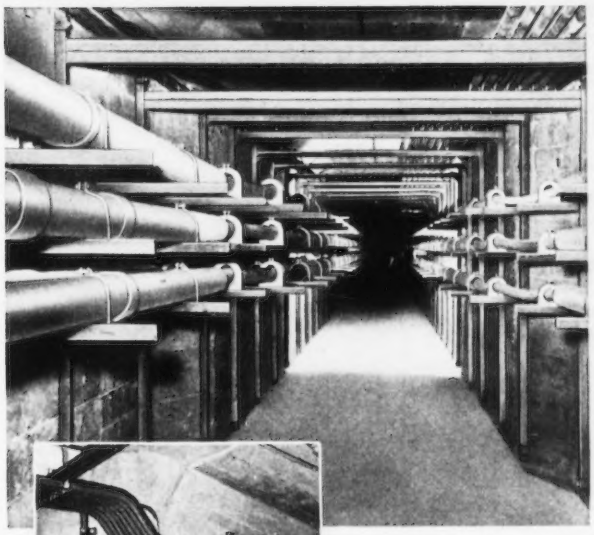
Diesel Mechanical, Diesel Hydraulic, Diesel Electric, Alcohol and Gasoline Locomotives from 3 to 70 tons

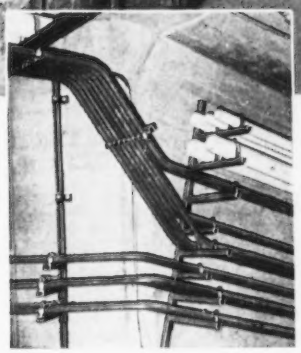
Heavy, medium and light duty trailers for industrial uses



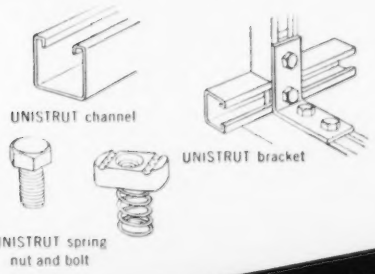
Mining Locomotives with low center of gravity and short wheel base

PSC PRESSED STEEL CAR





Unistrut metal framing can be used as a support for power cables, as shown above, and for practically every rack and shelving installation. Unistrut requires no hole drilling, no welding—is 100% adjustable and is 100% re-usable.



Pressed Steel Car Company offers a wide line of industrial cars and equipment

TO GET COST-CUTTING, TOP PERFORMANCE FOR TODAY'S INCREASED PRODUCTION DEMANDS

. . . it is essential you use equipment designed with the answer to *your* problems and *your* objectives—BUILT RIGHT IN!

HOW IS THAT DONE?

By close consultation with you, a thorough understanding of your specific needs . . . a knowledge gained in more than 50 years of producing equipment that has had to perform many jobs—in many ways—under varying conditions throughout the world. Satisfying many mining requirements, Pressed Steel Car Company supplies cars and other equipment some of which we show here. Each car or piece of equipment is designed to excel at a particular job. Your requirements may be different. The daily task of our extensive Engineering and Research Department is to make certain YOUR requirements are satisfied with the latest known technological advances. In this way, Pressed Steel Car Company makes its equipment more productive . . . over a longer working life.

IMPROVED PERFORMANCE AND EFFICIENCY—the right answer to your problem—can be found in Pressed Steel Car Company equipment.

Pressed Steel Car Company offers complete facilities for the study of YOUR particular problem. Attach a brief outline of your requirements to the coupon provided and forward both to the address indicated. There is no obligation.

Steelcar

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Please send me information on the following products:

- ☐ Agricultural Railway cars
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CHROME ORES

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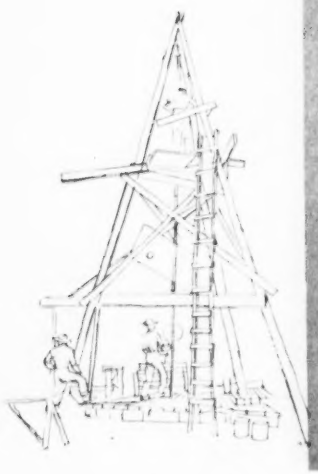
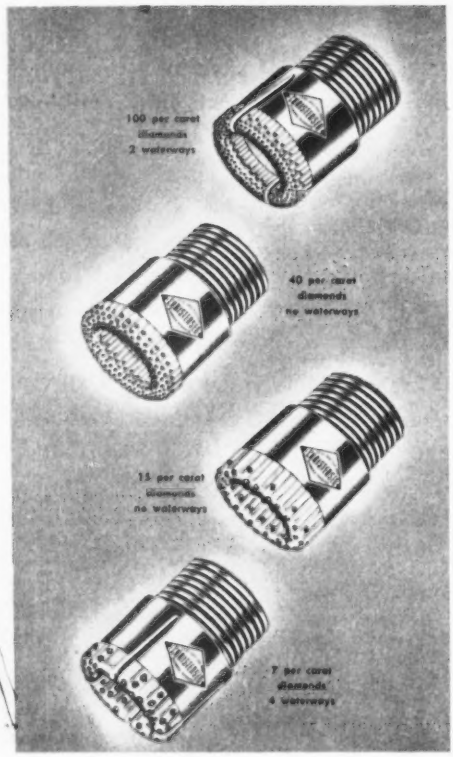
IRON ORES





THE RIGHT TYPE BIT

on your rig . . . for your drilling problem

The character of the ground to be drilled determines the type bit recommended for your operation. The number of waterways can be varied or omitted entirely. Diamond size and grade, matrix hardness are also variables. Knowing which type to recommend for your particular operation is the job of our field engineers. Call on their knowledge to select the right type.

CHRISTENSEN

CHRISTENSEN

DIAMOND PRODUCTS COMPANY

1937 South Second West — Salt Lake City, Utah

Minnesota (*Continued*)

700,000 tons of ore which average 20 ft. in thickness. The rest of the ore will be mined by Cleveland-Cliffs underground.

M. A. Hanna Co. is trying out a new Joy Manufacturing Co. rotary drill at its Perry mine between Keewatin and Nashwauk. Two sizes of bits are being used: 6¾-in. and 8¾-in. So far the drill has not been tried in wet holes. While it is too early to report definitely, it is understood that performance of the drill is satisfactory as compared with churn drilling in hard material.

Sylvia-Dee Mining Co. has been organized to start operation on the Judson mine at Buhl. Plans call for the stripping of 50,000 yd. and loading of 125,000 tons of ore this year. Sale of the ore is under a contract with M. A. Hanna Co. The operation will be carried on with a two-yard shovel and a fleet of 22-ton Euclid trucks. A crushing and screening plant will be installed.

NEW MEXICO

Mex-Tex Mining Co. Inc. Project: Lead-fluorspar-barytes mine and mill. Capacity: 150 tons of ore per day. Cost: $150,000. Starting date: 1953. Grade of ore: 45% barytes, 4% lead, 10% fluorspar. About 90% of the mining is open-pit, balance by drift where lime overburden is too heavy. Ore from drift is removed by slusher to loading ramp, then loaded by "dozer" or Austin Overshot loader into trucks for 35-mile haul to mill at San Antonio, N. M. Mill uses jigs and tables for gravity separation and concentration. Ore reserves are estimated to be more than 3-million tons.

Haystack Mountain Development Co. Project: Uranium mining near Grants. Start of operation: Jan. 1, 1953. Progress: Properties are being stripped preparatory to open-pit mining.

Adee Dodge Enterprises, Inc. Project: Uranium mining five miles southeast of Gallup, N. M. Underground methods are used. This ore deposit occurs on the hogback which marks the northwestern end of the Zuni uplift.

Hanosh Mining Co. Project: Uranium open-pit mine, 15 miles north of Grants. Starting date: May 1, 1953.

White and Mathis Mining and Exploration Co. Project: Fluorspar exploration at Greenleaf mine 12 miles northeast of Deming. Grade of ore: 60% CaF_2. Unwatering mine by drilling 500-ft. churn drill hole and installing large turbine pump.

J. B. Close Project: Open-pit iron mine at Ferro Iron Mines property. Grade of ore: 65% Fe. Rate: 100 tons per day. Investment: $10,000. Start

(*Continued on page 224*)

THE ENGINEER'S REPORT

DATA

LUBRICANT RPM Delo Oils

UNIT Caterpillar D13000 diesel

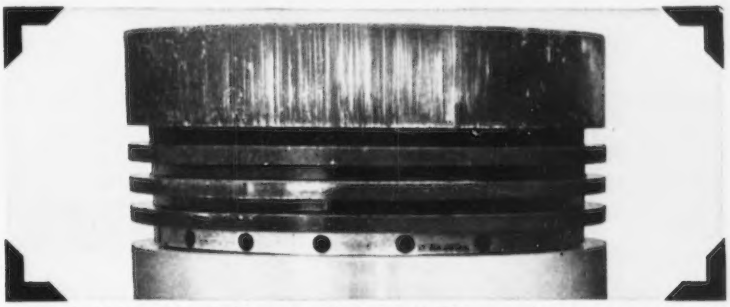
OPERATION Operating 75 KW generator

CONDITIONS Constant speed – varied loads + temp.

PERIOD 2119 hours

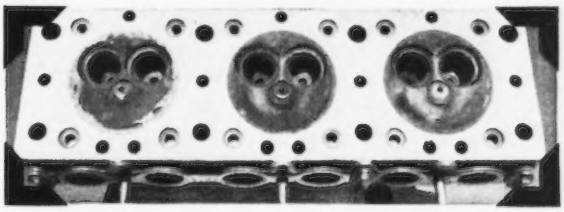
FIRM Lusitania, San Diego, Calif.

Ring-sticking stopped, wear cut in heavy-duty engine



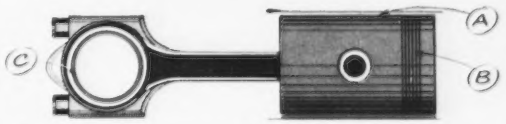
ONLY 0.0002 INCH WEAR PER THOUSAND HOURS was the average wear-rate on cylinders in the engine during the 2119-hour run, although usual drain periods were extended to 1000 hours. Oil temperatures averaged 175° F. to 180° F. Note the open oil-return holes and grooves (above) and lacquer-free piston skirt (left).

AFTER 2119 HOURS on RPM DELO Supercharged-2 Lubricating Oil, this representative piston from a D13000 Caterpillar indicates the clean condition of lubricated parts of the engine. All 24 rings in the engine were free!



CYLINDER HEAD from the engine after the run. RPM DELO Supercharged-2 is recommended specially for heavy-duty engines where fuel-sooting or other deposits, high temperatures or other conditions cause operational problems and wear.

How RPM DELO Oils keep engines clean and prevent wear



A. Contain special additives that provide metal-adhesion qualities...keep oil on parts whether they are hot or cold, running or idle.

B. Anti-oxident resists deterioration of oil and formation of lacquer...prevents ring-sticking. Detergent keeps parts clean, helps prevent scuffing.

C. Special compounds stop corrosion of any bearing metal, and oil foaming in both wet and dry sump engines.

There is an RPM DELO Oil to meet every heavy-duty engine operation condition.

FREE BOOKLET on the RPM DELO Oils gives you complete information. Write or ask for it today.

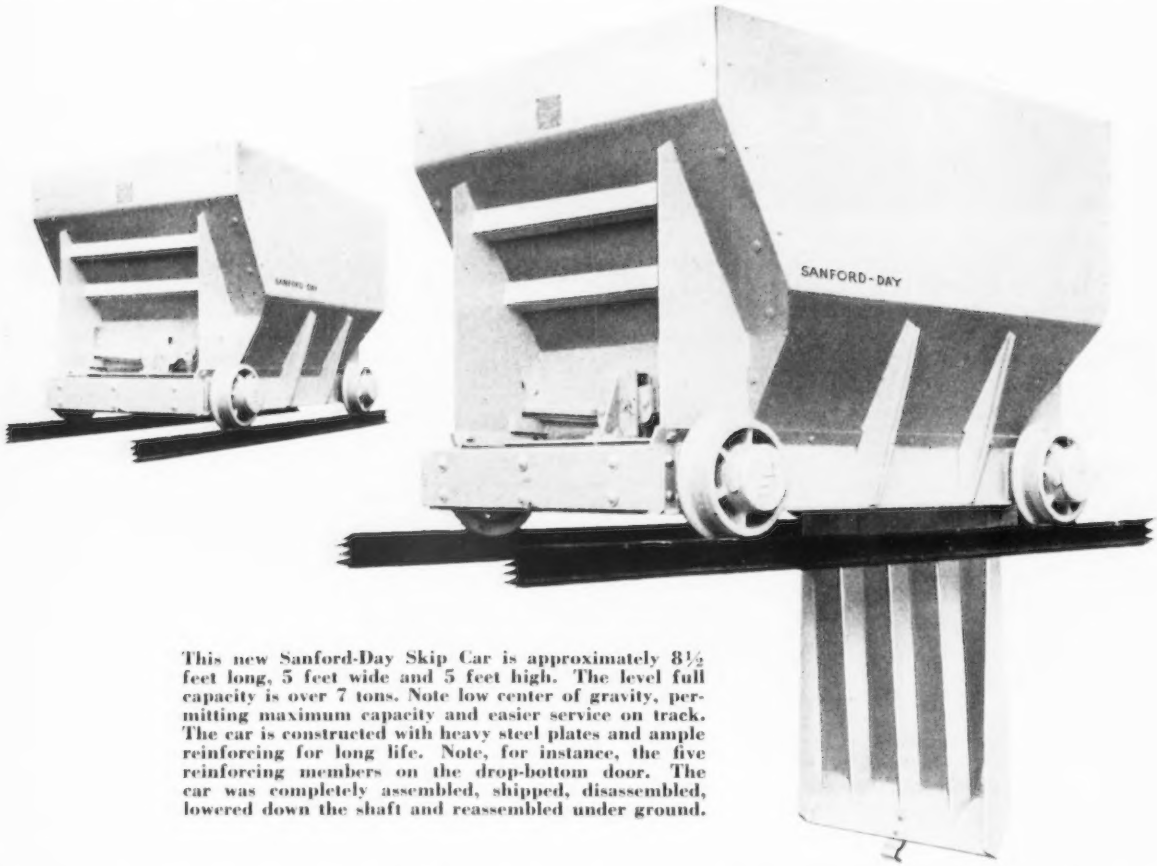
RPM DELO LUBRICATING OILS

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any of the companies listed below.

TRADEMARKS "RPM DELO" REG. U.S. PAT. OFF.

STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20 • STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA OIL COMPANY, Barber, New Jersey • THE CALIFORNIA COMPANY, Denver 1, Colorado

New One-Door Bottom Dumping Skip Car Built for Development Work at Resurrection Mine



This new Sanford-Day Skip Car is approximately 8½ feet long, 5 feet wide and 5 feet high. The level full capacity is over 7 tons. Note low center of gravity, permitting maximum capacity and easier service on track. The car is constructed with heavy steel plates and ample reinforcing for long life. Note, for instance, the five reinforcing members on the drop-bottom door. The car was completely assembled, shipped, disassembled, lowered down the shaft and reassembled under ground.

To work a new development at the Resurrection Mining Co. at Leadville, Colo., a 16° winze was required for moving material to two 100-ton capacity pockets located at top and directly beneath the inclined slope.

An automatic bottom dumping car was the only practicable solution. A short car, only 8½ feet overall, was required for loading by the mucker and therefore only one bottom-dumping door could be used. In addition, the bin lengths were only 10 feet, necessitating a short car.

In collaboration with the customer's operating officials, we designed and built this one-door type Sanford-Day Bottom Dumping Skip Car that solved the problem. The car is moved by cable and hoist, which is located about 60 feet beyond the pockets. A selective tripping device, mounted at one side of track, trips the car door at either pocket for discharging load.

We bring this new car to your attention as another example of Sanford-Day's ability and aggressiveness in solving the metal and non-metallic mine operator's many haulage problems. Regardless of what your mine car needs may be, it will pay you to let us engineer and build cars to suit your own requirements.

SANFORD-DAY IRON WORKS

KNOXVILLE
TENNESSEE

Maximum Footage – Maximum Economy

with JOY DUAL-VALVE SILVER STREAK DRILLS

In tunnels, crosscuts, drifts, or stopes, Joy *Silver Streak* Rock Drills with the DUAL VALVE will do your drilling job faster, and use less air with lower maintenance. Here's why—

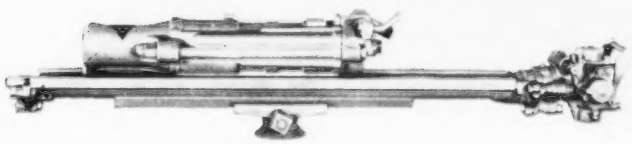
(1) The exclusive DUAL VALVE, a feature of all Joy rock drills, makes air do more work. By admitting the correct amount of air behind the piston and excluding air ahead of it during the drilling stroke, maximum force is exerted on the drill steel. There's no cushion of air ahead of the piston to reduce the force of the blow. Then the rear section of the Dual Valve meters the correct amount of air ahead of the piston to force it back with a "snappy" rotating action. This adds up to more power-packed strokes per minute, for faster drilling with less air.

(2) The silver-like cadmium plating on Joy *Silver Streak* Rock Drills aids lubrication while running-in, protects parts from rust while in stock, and keeps maintenance costs at a minimum.

The Joy line is complete. There's a *Silver Streak* rock drill for every rock breaking need. Types included are drifters, stopers, hand-held drills, Hydro Drill Jibs. To complete the line, there are wagon drills; the QB-20 for line drilling and dimension stone quarries; rubber-tired, self-propelled Drillmobiles; and specially mounted drills for special needs. Let our Field Men work with you. • *Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.* In Canada, *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

JOY **DUAL VALVE**

"Makes Air do More Work"



JOY **DRIFTERS**

For use on mobile jumbo units, as at right, or for column mounting, Joy Drifters are built in three sizes—all with fast, powerful Dual Valve action. Efficient Pistonmotor Feed, with only two moving parts, provides strong, steady, advancement and retraction. One-piece locking chuck increases bearing area and reduces wear on lock ring and chuck bushing.

Consult a Joy Engineer

JOY

WAD 3760

WORLD'S LARGEST MANUFACTURER OF UNDERGROUND MINING EQUIPMENT

New Mexico *(Continued)*

of project: April, 1953. Ore is mined with ¾-yd. Koehring shovel and "dozers" and hauled by truck 3 miles to railroad.

Haile Mines, Inc. Project: Manganese mine and treatment plant at Lake Valley. Grade of ore: 15-20% Mn. Capacity of plant: 10 tons per hr. Start of project: June 3, 1953. Ore is mined by open-pit and underground methods. Plant will use Heavy-Media process to upgrade ore. Product will go to Deming purchasing depot.

Anaconda Copper Mining Co. Project: Uranium plant at Bluewater to extract uranium. Start of plant: Scheduled for Aug. 1, 1953. Cost: Believed to be several million dollars.

International Minerals and Chemical Corp. Project: New chemical plant and storage building at Carlsbad. Cost: $4-million. The new plant will produce magnesium oxide and hydrochloric acid as a by-product. The company is also working on a dry process to treat sylvite.

Potash Co. of America. Project: Underground mine, and mill expansion at Carlsbad. Cost: $3-million. Company is developing its underground continuous mining method. Four continuous miners will be added to the four units now operating. The program also involves the purchase of modern belt conveyor systems.

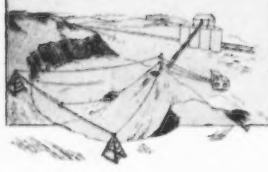
U. S. Potash Co. Project: New mine shaft being sunk to 1300 ft. level. Cost: $1-million. Progress: Work began about a year ago, will be completed late this year.

Lucky and Greenspar Mines. Project: Two mines about 12 miles north of Deming. Product: Fluorspar. Grade: Average about 70%, but as high as 95% in some areas. Capacity: Will be increased from 50 tons per day to 100 tons per day for both mines.

ONE MAN CONTROL

DIGGING • HAULING

AUTOMATIC DUMPING



A 50-year accumulation of waste coal silt at a Pennsylvania mine is being reclaimed by a 3 cu. yd. Sauerman Power Scraper to a processing plant where the waste is converted into usable fuel. The above photo shows the scraper making its first cut into the pile, which is 1500' long, 700' wide and 50' high.

SAUERMAN EARTHMOVERS

Labor saving efficiency . . . low initial cost . . . rugged digging and hauling power . . . all-around versatility . . . and moderate power requirement . . . are distinct advantages that have made Sauerman Earthmoving Machines famous for over forty years. Sauerman Machines spot and dump automatically under the easy control of an operator situated in a comfortable cab overlooking the work area.

Drag Scraper Excavator: Combines digging power, hauling speed and long reach for efficient pit or hill excavation, reclamation and handling of materials, wet or dry.

Slackline Cableway Excavator: Unequalled for operations that require deep digging, especially under water, and delivery to a high point. Reaches hundreds of feet into ponds, wet pits, sludge basins and similar areas, while operator remains in a safe location overlooking work area.

Mobile Tower Excavator: Self-propelled drag scraper machine, affording great digging capacity, long reach and exceptional mobility. Ideally suited to stripping operations, pit excavation, re-handling mine waste and for stockpiling.

Scrapers on Boom Machines: Sauerman Crescent Scraper buckets are invaluable as auxiliary digging equipment for boom machines. Use of a Crescent bottomless bucket in place of a conventional dragline bucket increases the capacity of a boom machine on work where material has to be moved but not lifted. The boom machine-Crescent Bucket combination is widely used for scraping gravel to a ground hopper.

The different Sauerman machines are described in detail in a series of catalogs, liberally illustrated with drawings and photographs. Tell us about your material handling problems and we will send you the catalogs that will be of most interest to you.

SAUERMAN BROS., Inc. 584 S. CLINTON ST. CHICAGO 7, ILLINOIS

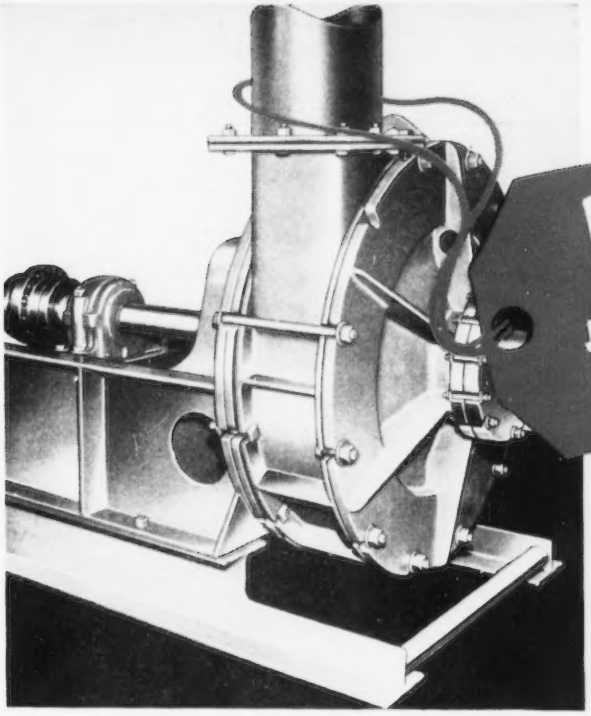
NEW YORK

Jones & Laughlin Steel Corp. Project: Plant expansion of the martite section of Benson Mines, St. Lawrence County. Capacity: 300,000 gross tons, in addition to 1-million gross tons of magnetite concentrate produced at original plant. Progress: Plant was started in 1950 and placed in operation in 1952. Cost of project: $5-million. The new plant was started to process non-magnetic martite. The martite is fed to the same crushing plant as the magnetite ore, then through a 9 x 12-ft. rod mill. Separation is made by a battery of 80 rougher, 40 cleaner, and 40 re-cleaner spirals. The product passes through a vacuum filter, and then to the sinter plant. Mine equipment was increased to feed this new plant. Added pit equipment included a 5-yd. shovel, trucks, churn drill and bulldozer. The garage, machine shop, and warehouse were expanded, and a new office building constructed.

Jones & Laughlin Steel Corp. Project: Sinter plant expansion at Benson Mines. Capacity: Enlarged to handle 300,000 gross tons of martite concentrates. Progress: Construction started in 1951, was completed in 1952. Total cost: About $4.4-million. A third Dwight-Lloyd sintering machine was added. Size is 78¾-in. x 147 ft. long, including a cooling system which was not included in the original units. The sintering air fan is driven by a 1,000-hp. motor, and the cooling fan by a 500-hp. motor. The four silos are approximately 20-ft. inside diameter by 46-ft. high in a rectangular shell. Space between the shell and silo walls is heated by two 1-million btu air units.

PUERTO RICO

The Department of Industrial Research reports that studies are under way to determine the commercial value of a bentonite deposit in the Aguada area. Elsewhere beach sands are being tested as a possible source of magnetite and ilmenite.



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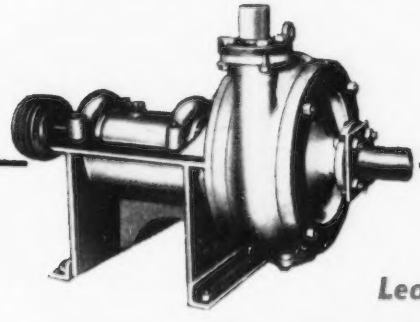

Built for acid service, this newly installed 8-inch Vacseal Pump will operate 24 hours a day, with capacity to handle 3,000 g.p.m. 150-foot heads and 10- to 12-foot suction lifts. Fabricated design, with welded steel construction, provides light weight sections and room for the acid-proof protection of gum rubber that is ½ to 1½" in thickness.

The stainless steel shaft sleeve and gland bushing are replaceable. Temperatures to 180° F. Dimensions: 10' long, 5½' high, 4' wide. Weight: 4800 pounds.

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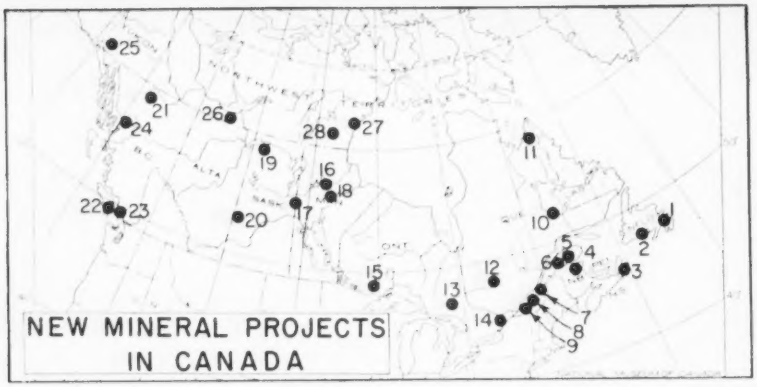

IN CANADA

Key to Map of New Mineral Projects in Canada

1. Wabana Iron Mines, Newfoundland.
2. Fluorite Deposits, Newfoundland.
3. Mindamar zinc-lead-copper, Nova Scotia.
4. Bathurst zinc-lead-copper-tin, New Brunswick.
5. Gaspe Copper, Quebec.
6. Federal Lead and Zinc, Quebec.
7. Eastern Metals, nickel-zinc, Quebec.
8. Asbestos Mines, Quebec.
9. Weedon, Suffield, and Huntingdon Mines, copper, Quebec.
10. Iron Ore Developments, Quebec-Labrador.
11. Fenimore Iron Ore deposits, Quebec.
12. Barvue, zinc, Quebec.
13. Sudbury nickel-copper area, Ontario.
14. Marmoraton Mining Co., iron ore, Ontario.
15. Steep Rock Iron Mines, Ontario.
16. Lynn Lake nickel-copper, Manitoba.
17. Flin Flon mine, copper-zinc, Manitoba-Saskatchewan.
18. Mystery Lake, nickel, Manitoba.
19. Beaverlodge area, uranium, Saskatchewan.
20. Potash deposits, Saskatchewan.
21. Cassiar Asbestos, British Columbia.
22. Vancouver Island, iron ore, British Columbia.
23. Texada Island, iron ore, British Columbia.
24. Portland Canal area, copper, British Columbia.
25. Kluane Lake area, nickel-copper, Yukon.
26. Pine Point, lead-zinc, Northwest Territories.
27. Rankin Inlet, nickel-copper, Northwest Territories.
28. Ferguson Lake, nickel, Northwest Territories.

BRITISH COLUMBIA

Consolidated Mining & Smelting Co. of Canada, Ltd. The following projects, totaling about $65-million, are now underway at various western properties of COMINCO; investment involved for each project is also given:

Waneta dam and power plant ($30-million); modernization of the Trail smelter ($15-million); phosphate fertilizer plant at Kimberley ($9-million); Trail zinc plant enlargement ($3.2-million); power transmission line from Kootenay River to Kimberley ($2.85-million); power transmission line from Waneta to Trail ($1.9-million); and the H.B. mine where preparation for production is now under way ($3-million).

Aluminum Co. of Canada. Project: Kitimat-Kemano hydro-electric plant and aluminum smelter. Estimated investment thus far: $200-million. Progress: Smelter is scheduled to start on May 1954 with two potlines,

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FORMIC ACID 87-90%, Reagent, A.C.S.

HYDROCHLORIC ACID 35-37%, Reagent, A.C.S. (Sp. Gr. 1.18)

HYDROFLUORIC ACID 48%, Reagent, A.C.S.

NITRIC ACID 70%, Reagent, A.C.S. (Sp. Gr. 1.42)

PERCHLORIC ACID 70-72%, Reagent, A.C.S. 60%, Reagent, A.C.S.

PHOSPHORIC ACID Ortho, 85%, Reagent, A.C.S.

SULFURIC ACID 95-96%, Reagent, A.C.S. (Sp. Gr. 1.84)

SULFUROUS ACID 6% Sol., Reagent, A.C.S.

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Canada *(Continued)*

output to be 83,000 metric tons of aluminum produced from Jamaica bauxite ore. New U. S. contracts worth ($300-million, for the sale of 786,000 tons of aluminum, has resulted in the authorization for two more potlines. This will double the size of the project, but production date will be deferred.

Ventures Ltd.-Frobisher. Project: Hydro-electric project at Tulsequah to produce a 25,000-hp. to start. This will supply a ferro-alloy plant with a reported capacity of 25,000 tons of ferro-alloys per year. Project surveys are now in progress.

Silver-Van Consolidated Mining and Milling Co. Project: New 150-ton mill near Smithers, B. C. Investment: $1.07-million. Grade of ore: 10.4 oz. silver, 0.11 oz. gold, 6.2% lead, and 8.6% zinc. Production to come from the Canary-Hummingbird mine. Start of production: June, 1953. Lead concentrates go to Helena, and zinc concentrates go to Trail smelter.

Cassiar Asbestos Co. Project: Asbestos mine and mill in Macdame Lake area. Progress: Production rate scheduled for 150 tons this year, to be increased to 500 tons by next year. Investment: Estimated to be about $4.5-million.

Western mines showing good profits today have used Card cars for years. Some are now replacing their original order after 10-20 years...with Cards of course.

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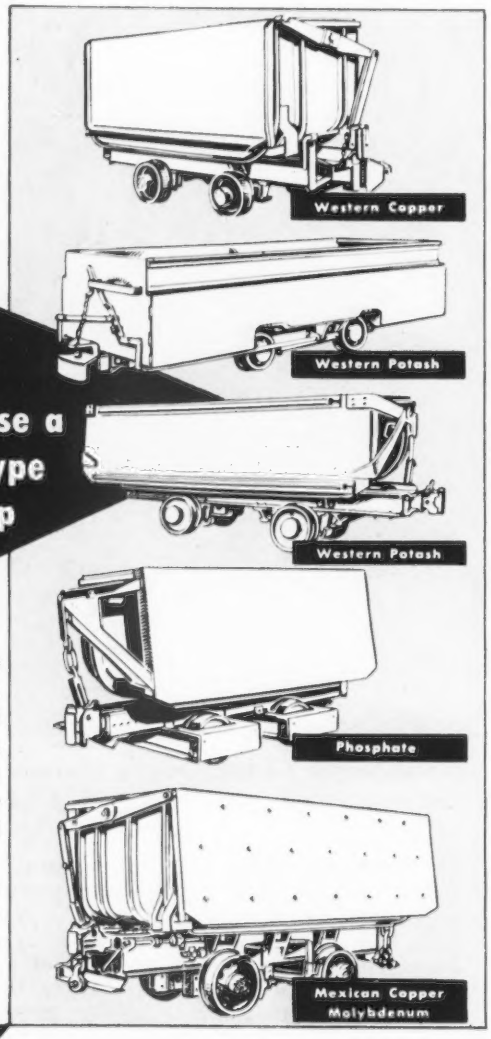

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NEWFOUNDLAND

Newfoundland Fluorspar Ltd., one of Canada's two top fluorspar producers, is branching out into exploration work. Rights have been obtained on 500 sq. miles of Burin Peninsula, site of 90% of the country's fluorspar output. The company, wholly-owned subsidiary of Aluminum Company of Canada, expects to double its production, possibly triple it, during the next few years, and the new move is a logical step toward the development of new deposits. Current production is about 40,000 tons annually.

NOVA SCOTIA

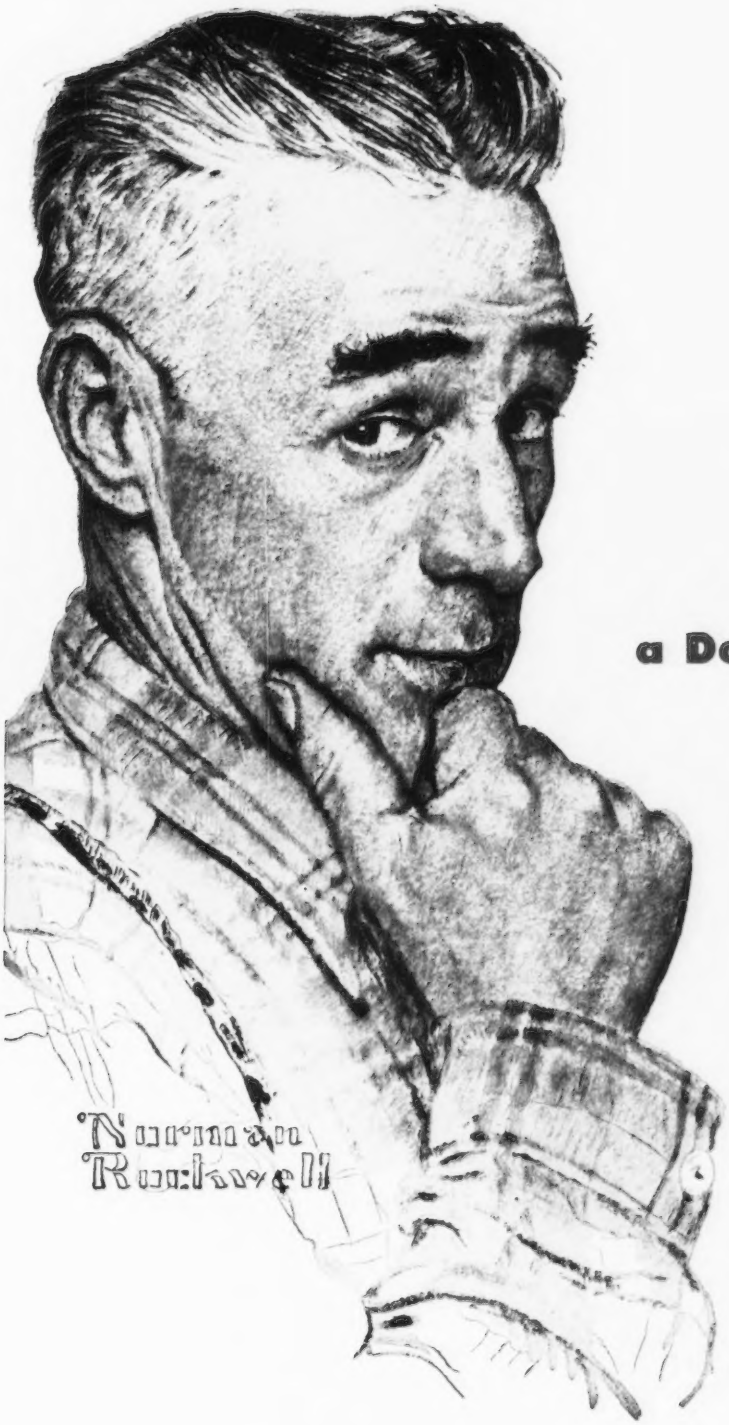
Mindamar Metals Corp. can be expected to show good results in 1953, its second year of zinc-lead production. This Dome-sponsored junior base metal made a good showing in 1952. The company has contracts for metal that were made at fixed prices some time before the metal markets broke last year. Ore reserves at year-end were estimated at 368,514 tons, a gain of more than 86,000 tons over the tonnage with which production was started. Mindamar is located on the east side of Cape Breton Island. A new exploration venture on a big scale is now being started in the island's northwest section, where Cape Breton Metals Ltd. has obtained all mineral rights, except for coal, on a 1,500-sq. mile area. First step in the search is an airborne magnetometer survey, now in progress. The new company is controlled by The Mineral Exploration Corp., Toronto.

ONTARIO

Nickel-copper and iron ore hold the front rank in expansion and development in Ontario.

In the Sudbury area the program of post-war expansion continues at an accelerated pace. The International Nickel Company's objective of treating 13-million tons of ore annually was exceeded in 1952. Improved mining and metallurgical methods have made possible the utilization of large tonnages of lower grade ore. A recently announced metallurgical development will add an additional 2-million pounds of nickel per month to the present output. The other major producer, Falconbridge Nickel Mines Ltd. is engaged in an extensive program of expansion that in a couple of years will more than double the present production of the company. The Hardy mine is expected to begin operations this year at a rate of 2,000 tons per day. Active development of the Fecunis Lake deposit, where 10-million tons of ore has been indicated by

(Continued on page 230)



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Canada *(Continued)*

diamond drilling, is under way. This will also be a 2,000-ton per day operation. The old Mount Nickel property is being re-opened for a 300-ton per day operation. Other developments are planned. To handle this increased tonnage of ore, additional smelter capacity will be required and the erection of a second smelter is anticipated.

In addition to the major producers, several smaller companies are about to come into production. East Rim Nickel Mines Ltd. is building a 500-ton capacity mill and Nickel Offsets Ltd. will be operating its 300-ton mill in the course of a few months. Milnet Mines Ltd. is mining ore at the rate of between 7,500 to 10,000 tons per month.

Ontario Pyrites Ltd., in the Sudbury Basin, is actively developing two zinc-lead-copper deposits where diamond drilling has indicated well over 3-million tons of ore.

Quebec Nickel Corp. Project: Exploration on properties north of Kenora, northwestern Ontario. Grade: Currently management estimates tonnage at 5,400 per vertical ft. Grade averages 1.4% nickel, 0.65% copper, with about $1 in precious metals also present.

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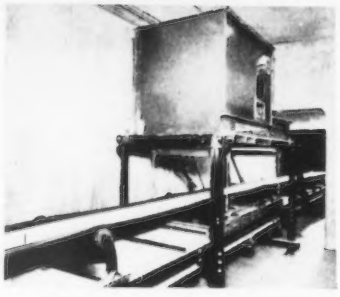
Merrick's close association, of over 40 years, with the mining industry assures the weighing tools of tomorrow.



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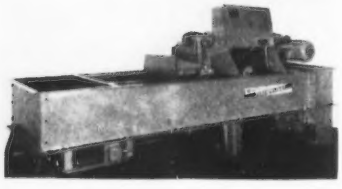

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Center Lake Uranium Mines. Exploration project for uranium. Latest reports indicate 278,000 tons of 0.08% uranium ore. Metallurgical tests now are being run by the Department of Mines.

Steep Rock Iron Mines. Engaged in a program that will increase iron ore output from 1.2-million tons annually to 5.5-million tons by 1958. This involves: (a) Establishment of No. 1 underground Errington mine, which will start production this summer. The shaft has been sunk to 1,250 ft. and levels established at 700, 900, and 1,100 ft. This mine will replace the present Errington open pit, to be abandoned this summer. (The mine is under the pit.)

(b) No. 2 Errington underground mine.

(c) Start of open-pit mining at the Hogarth mine, following completion of dredging operations 1950-53. Production will start this summer.

(d) Start of open-pit mining on the "G" orebody, lying between the Errington and Hogarth mines. It will require about four years to develop.

Investment: No official figures given; unofficial estimates $30-million.

Inland Steel Co. Plans to start iron ore production by 1958 from the "C" iron orebody which it has leased from Steep Rock Iron Mines on a royalty basis. Operating company is Caland Ore Co., estimated cost $50-million, and initial production objective 3-million tons of iron ore annually. The output will be sold to the parent company.

Falconbridge Nickel Mines. Developing three new mines—the Hardy, the East Falconbridge, and the Fecunis Lake, all in the Sudbury area. Shafts are completed for the time being at Hardy and East Falc., and one is now being planned for Fecunis, scene of last year's major drilling discovery

Finishing touches are now being put to concentrator expansion (rate will be 2,500 tons daily), and to refinery expansion and modernization in Norway.

Roy Silver Mines is building a 100-ton mill on its property near Cobalt, Ont. (silver-cobalt) and expects to get into production next fall.

Holwood Mines is readying a 50-ton mill, also silver-cobalt, on its Gowganda property, Van Hise Twp. It should be treating ore by mid-summer.

Campbell Red Lake Mines. Will increase its mill from 500 to 750 tons, the increase to be effective by next spring. Total cost of the increase and a shaft-deepening job of 1,000 ft. is estimated at $750,000.

Marmoraton Iron Mines. Subsidiary of Bethlehem Steel Corp., planning to mine by open pit a magnetite deposit near Marmora, Ont. Plans call for a plant to produce 400,000 tons of concentrates annually. Production by late 1954 or early 1955.

(Continued on page 234)

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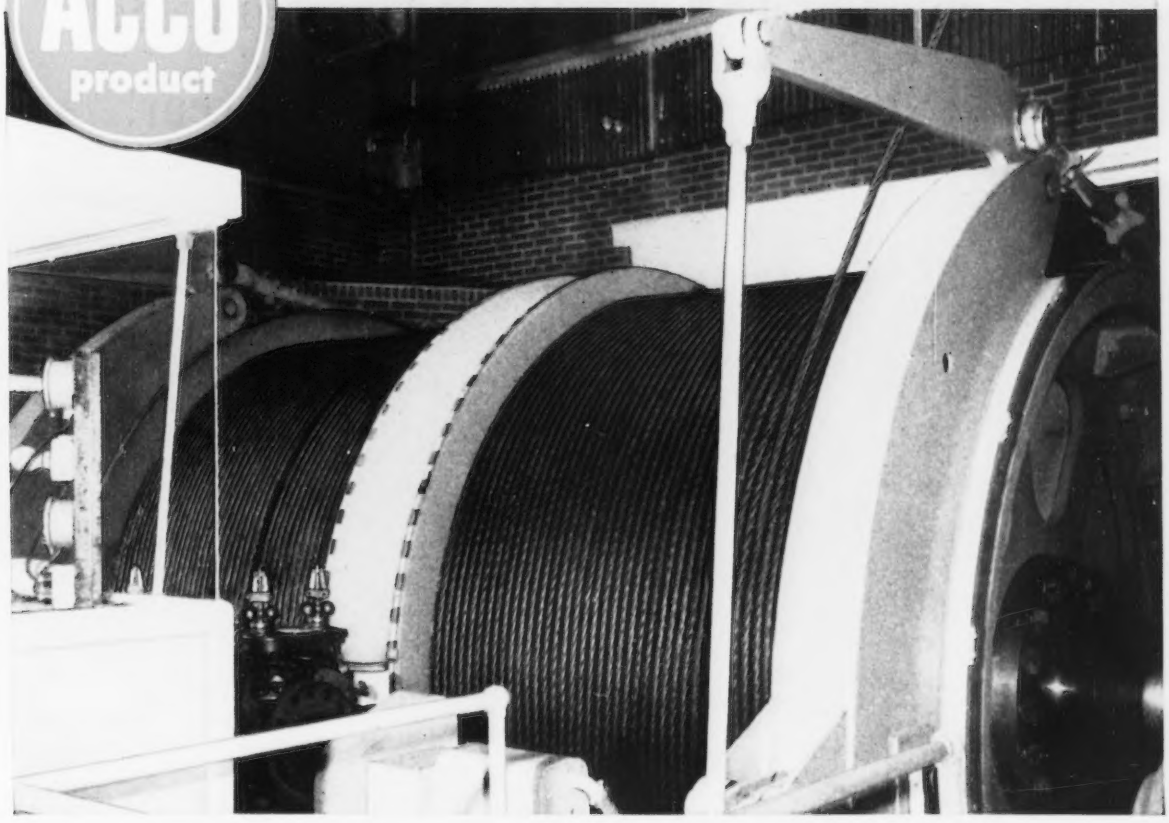
TRU-LAY Preformed WIRE ROPE



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• The fine tonnage records set by TRU-LAY mine shaft ropes are due to their particular construction.

For many years AMERICAN CABLE engineers have checked carefully the service life of various constructions of wire rope. They found repeatedly that there is one grade of rope with the exact combination needed for highest strength and resistance to bending fatigue and crushing on the drum. Their experience records show consistently longer life which means lower operating costs.

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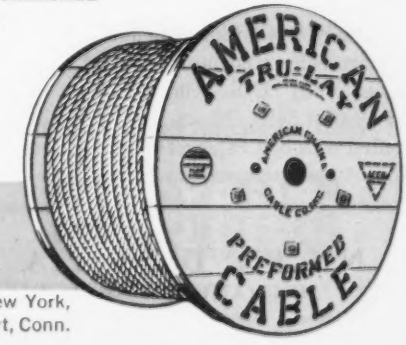
Write our Wilkes-Barre office for **DH-128-A** "Wire Rope Recommendations for Mining Industries."



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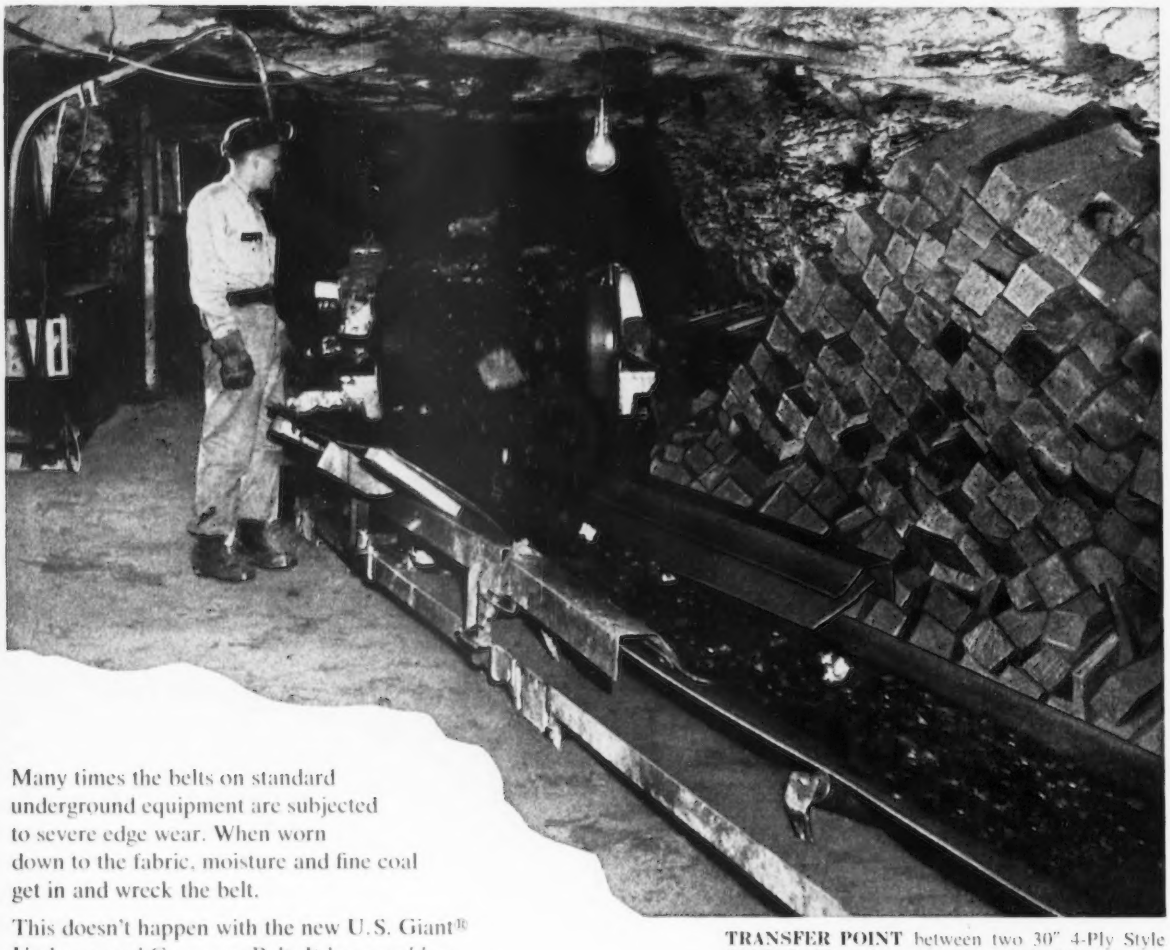

Many times the belts on standard underground equipment are subjected to severe edge wear. When worn down to the fabric, moisture and fine coal get in and wreck the belt.

This doesn't happen with the new U.S. Giant® Underground Conveyor Belt. It has a *rubber capping on the edges*—effectively prolonging service life.

Because you want long life and economy in your coal haulage belts, your best bet is to buy "U.S." There are 25 District Sales Offices, staffed with belt engineers to serve you.

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THE new Bucyrus-Erie Ward Leonard electric shovels bring to quarry loading the first important departure from the old-fashioned shovel front end. This advanced design — with two-section boom, inside tubular handle, and quiet positive rope crowd — increases speed and payload. It reduces upper boom weight, puts extra strength in the lower section where maximum strength is needed. It cuts out old-style handle racking and crowd pinions, takes the deadweight of crowd machinery off the boom. And, most important to *you*, it gives you all these field-proven performance advantages:

- **Lighter Weight, Greater Strength** — Two-section boom, with light upper section . . . lower section strut-connected to the A-frame.
- **No Handle Twist** — Inside tubular dipper handle is free to rotate in rubber-cushioned saddle block.
- **No Handle Binding in Saddle Block** — Rope crowd is quiet, positive, eliminates handle racking and crowd pinions.
- **No Dipper Wobble** — Twin dual hoist ropes put hoist power where needed for steady travel of dipper through bank.
- **No Sway Braces** — Widespread boom feet eliminate accessory boom braces or cables.
- **Low Swing Loads** — Advanced front end design, with crowd machinery on deck, cuts dead load on swing, steps up swing speed.
- **High Pay Loads** — Single tubular handle — with improved dipper back connections, dipper trip on saddle block, no dipper bail — reduces dead load on hoist, leaves more power for digging.

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Canada *(Continued)*

QUEBEC

Campbell-Chibougamau Mines Ltd. Project: Underground copper mine and mill at Merrill Island. Reserves: 1.05-million tons 3.5% copper. Production rate: 2,000 tons ore per day; 18,600 tons copper per year. Capacity output: 1955.

Noranda Mines Ltd. Project: Gaspe open-pit copper mine and mill. Investment: $35-million. Reserves: 67-million tons 1.3% copper. Production rate: 6,500 tons of ore per day; 25,000 tons of copper per year.

Ventures, Ltd. Project: Opemiska Copper Mines, Ltd. underground mine and mill. Reserves: 1,054,000 tons 4.82% copper, estimated. Production rate: 400 tons ore per day; 6,000 tons copper per year. Capacity output: 1954.

Molybdenite Corp. of Canada, Ltd. Project: Expansion of molybdenite mine in LaCorne Twp. Contract with the U. S. Government gives the U. S. an option to buy up to 6-million lb. of molybdenite during the next five years. Floor price is 63¢ per pound of MoS_2 contained in 90% concentrates.

Opemiska Copper Mines. Project: 400-ton mill in Chibougamau area.

Quebec Copper Corp. Project: Reopening of Huntington mine. New shaft has been sunk to 900 ft.

Noranda Mines Ltd. Project: Sulphur-iron plant at Welland, Ont. Capacity: 350 tons of pyrite concentrates per day. Product: SO_2 equivalent to 54,000 tons of sulphur per year, and 75,000 tons of high-grade iron oxide sinter. Starting date: The middle of 1954.

Noranda Mines, Ltd. Project: Mine and mill at Macdonald Mines, Ltd. property seven miles north of the Horne mine. Capacity: 1,500 tons per day. Grade of ore: 3% zinc and 78% pyrite. Size of orebody: 9-million tons. Progress: Plans and specifications are now being prepared for the mill. Orebody was developed several years ago. Noranda took a lease on 50 acres in which the orebody occurs. Macdonald intends to sell the leased area and other lands to a new company. Subject to satisfactory agreements being made, Noranda will provide funds to the new company to bring the property into production. In addition to producing a good zinc concentrate, this ore will yield a good pyrite concentrate for which it is believed that a good market will be found.

Johns-Manville Co. Project: New asbestos mill and mine expansion at Asbestos. Investment: More than $20-million. Capacity of new mill: 14,000 tons per day. Capacity of mine: 25,000 tons per day. Completion of construction: 1956.

Asbestos Corporation. Project: New open-pit mine and mill at Normandie property. Investment: $11.5-million (mill), $3-million (mine). Mine capacity: 5,000 tons per day. Mill capacity: 5,000 tons per day. Completion of construction: 1954.

Johnson's Asbestos Co. Project: Mine and mill near Black Lake. Investment: $7.5-million. Mine capacity: 6,000 tons per day. Mill capacity: 4,000 tons per day. Completion of construction: Late 1953.

Dominion Asbestos Co. Project: 2,200-ton mill. Investment: $2-million. Completion of construction: 1953.

Provincial Asbestos Co. Project: Mine and mill at Coleraine. Capacity of mine and mill: 500 tons per day to be increased to 1 to 2,000 in the future.

Barvue Mines, Ltd. Project: Open-pit mine and mill near Barraute, Que. Investment: $10.5-million. Milling rate: 4,000 tons per day. Mill capacity: Can be increased to 6,000 tons if necessary. Product: About 500 tons of 60.5% concentrates daily. Ore reserves: 14.3-million tons down to 700 ft. Grade of ore: 3.3% zinc, 5-6% pyrite, 1.1 oz. silver. Progress: Mill construction started in Jan. 1952, and was virtually completed by the end of the year. Mill started in October, 1952, and attained 4,000 ton-per-day throughout by early 1953.

(Continued on page 236)

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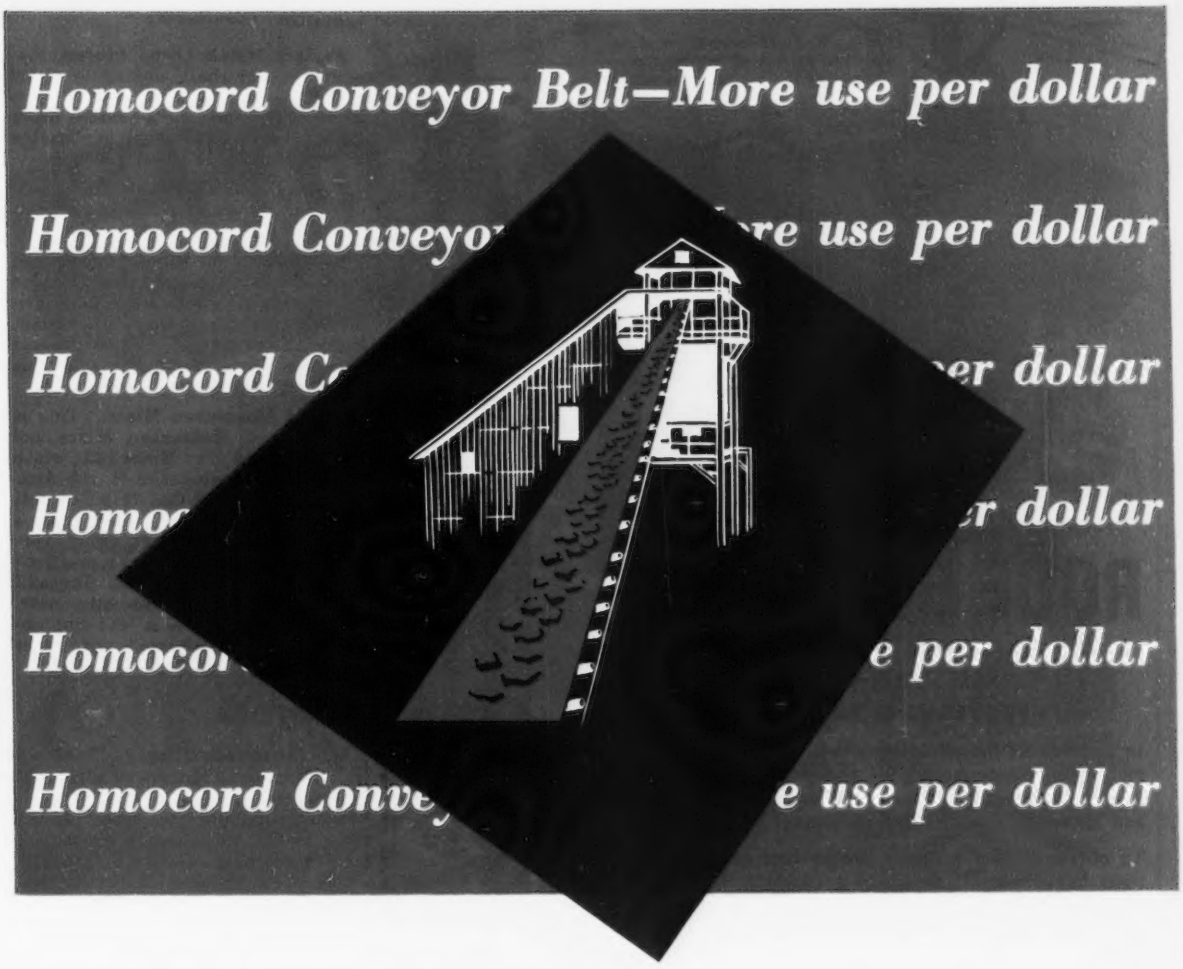
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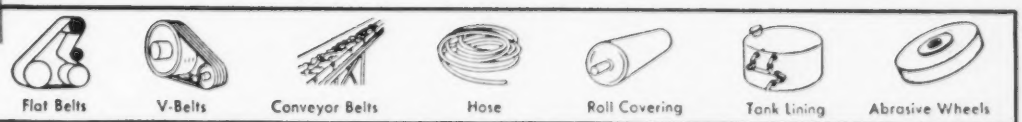

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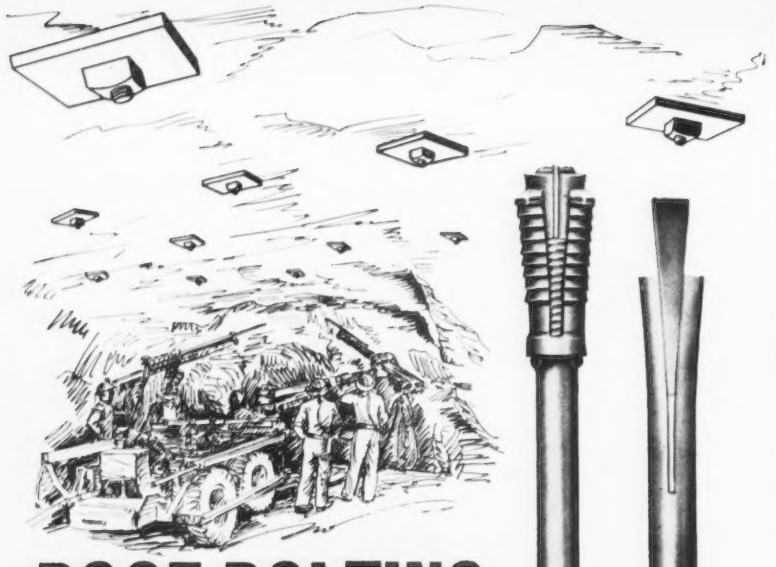

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- INCREASES PRODUCTION
- IMPROVES VENTILATION

In addition to the advantages listed, roof bolting eliminates timbering — provides a larger area for manipulating mechanized equipment — and allows an unobstructed movement of men.

To obtain better and more secure roof conditions West Virginia furnishes a complete line of wedge type and expansion sleeve type roof bolts and accessories. Thus, West Virginia provides roof bolts to meet the varying roof conditions encountered in both metal and nonmetallic mines.

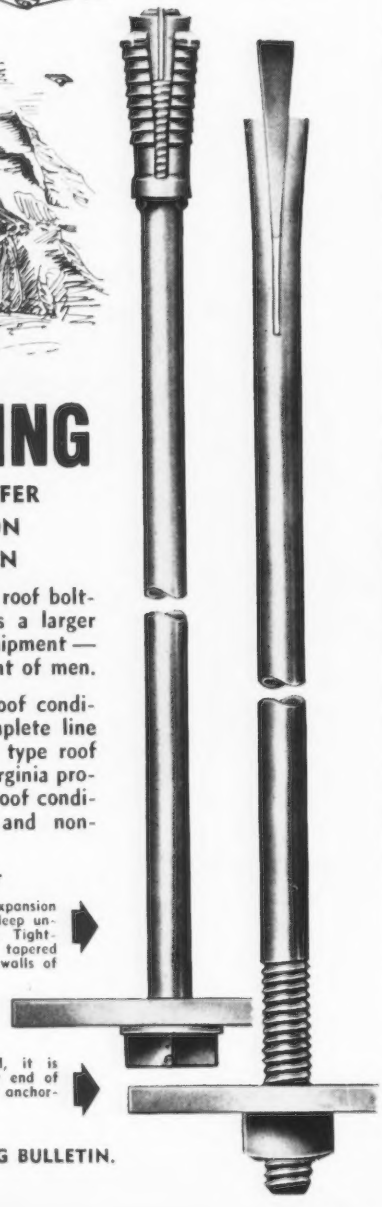
EXPANSION SLEEVE ROOF BOLT

is a ¾ inch cut or rolled thread bolt with expansion unit. Bolt is provided with pressed ears, square, deep unchamfered head and forged integral head washer. Tightening the bolt pulls conical plug into circular tapered seat in shell, forcing teeth of shell fingers into walls of hole without possibility of edgewise distortion.

WEDGE ROOF BOLT

consists of a 1 inch cut or rolled thread bolt slotted for 6 inches and wedge with semi-roughened surfaces. Unless otherwise specified, it is furnished with square nut. Driving bolt against end of hole forces wedge further into slot, thus, tightly anchoring bolt in hole.

WRITE FOR OUR NEW ROOF BOLTING BULLETIN.



Canada *(Continued)*

Eastern Metals Corp. Project: Exploration and shaft sinking in nickel orebody. Ore reserves: 800,000 tons. Grade: 0.81% nickel. A shaft is being sunk to carry out further exploration on this orebody in eastern Quebec.

Federal Metals Corp. Extensive exploration is being carried out by this company in North Gaspe county.

Fennimore Iron Mines. Deposits of concentrating ore estimated at more than 500-million tons have been discovered in northern Quebec-Labrador. Negotiations are planned to produce from this property, pending favorable agreements with European factors.

United Montauban Mines. This is a merger of Montauban Mines and United Lead & Zinc Mines Ltd., which had adjoining properties in the Anacon area, Portneuf Co., 70 miles west of Quebec City, Que. They built a 500-ton mill as a joint effort (the shaft was also a 50-50 proposition) and then decided to merge. The mill is just about ready to turn over. United Montauban is a lead-zinc operation, with some gold and silver values as well.

MANITOBA

Sherritt-Gordon Mines, Ltd. Project: Ni-Cu-Co underground mine, mill and refinery at Lynn Lake. Investment: $35-million. Reserves: 14,055,000 tons 0.618% copper. Production rate: 2,000 tons ore per day; 4,000 tons copper per year. Capacity output: 1955.

Hudson Bay Mining and Smelting Co. is developing a number of properties within a 20-mile radius of its main copper-zinc operations at Flin Flon.

Exploration of enormous bodies of nickel-bearing rock around Mystery Lake is being carried out. Diamond drilling and surface surveys are underway. The nickel grade is below present economic limits, but the extent of the deposits makes them potentially significant.

IN LATIN AMERICA

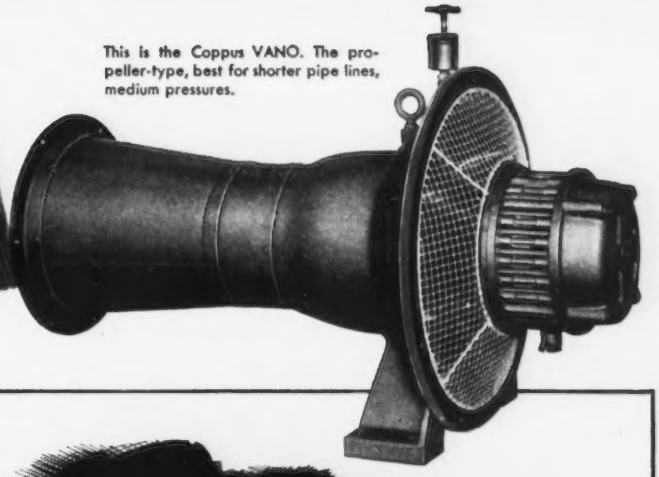
ARGENTINA

Sociedad Minera Argentina Soc. Anonima. Project: Tungsten production in provinces of San Luis, Cordoba, and Mendoza. Investment: $1.5-million. Product: Tungsten ores. Grade: 0.7% WO_3. Start of production: Accelerated output scheduled for late 1953.

Government owned Zapla iron mines are slated to operate at a higher rate

(Continued on page 242)

ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT



This is the Coppus VANO. The propeller-type, best for shorter pipe lines, medium pressures.

This is the Coppus VENTAIR. A centrifugal blower, it is designed for long pipe lines, high pressures.

These are the cost-reducing Blowers that give up to 100% more air

Only Coppus makes both types — and both are made especially for *mine* ventilation. One or the other, operating under the conditions for which it is designed, delivers from 30% to 100% more air for a given power consumption than an ordinary all-purpose fan.

They can be used as blowers or exhausters and are driven either by compressed air or electric motor, with capacities up to 90,000 CFM. Like all Coppus products, these blowers wear the "Blue Ribbon" that stands for high achievement in engineering, workmanship and performance.

Representatives listed in MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also THOMAS' REGISTER . . . Coppus Engineering Corp., Worcester 2, Mass.

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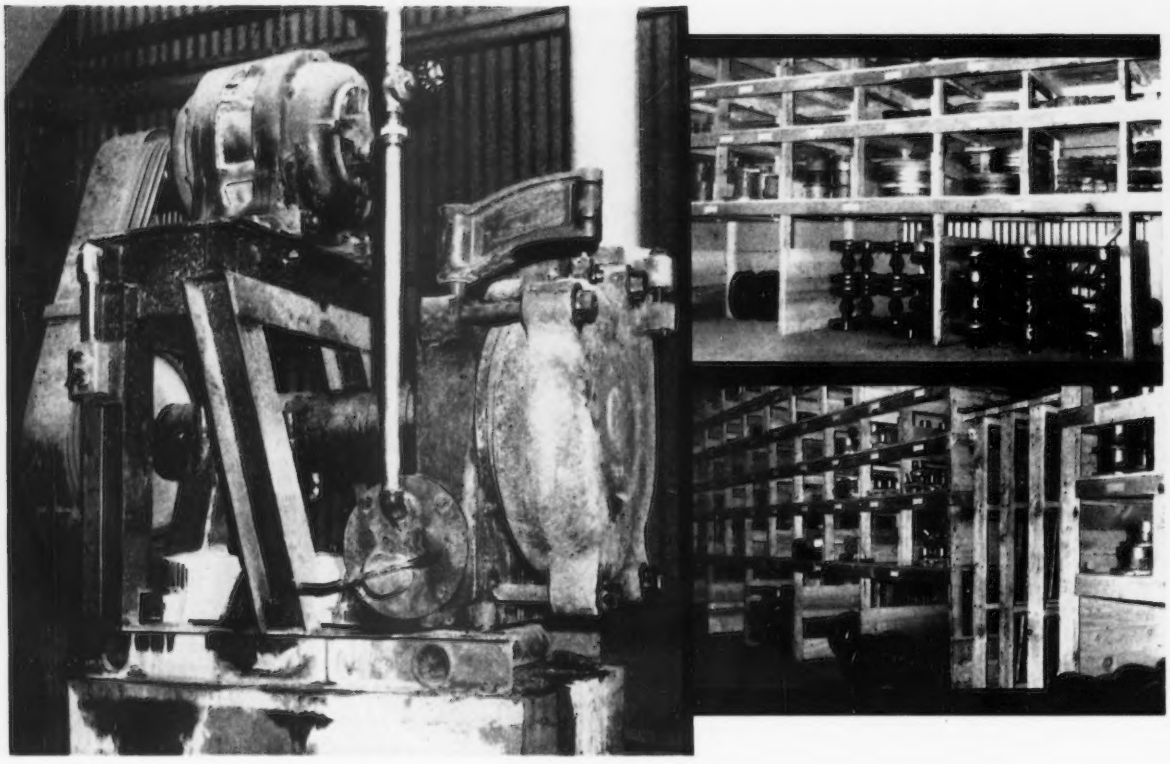

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SECOND — is Wemco's stockroom service that keeps **all parts** for **all sizes** available at **all times.** If ever your Wemco Sand Pump requires parts in a hurry, your telegram or phone call gets top priority attention. This prompt emergency service is standard procedure at Wemco, and is provided at no extra cost.

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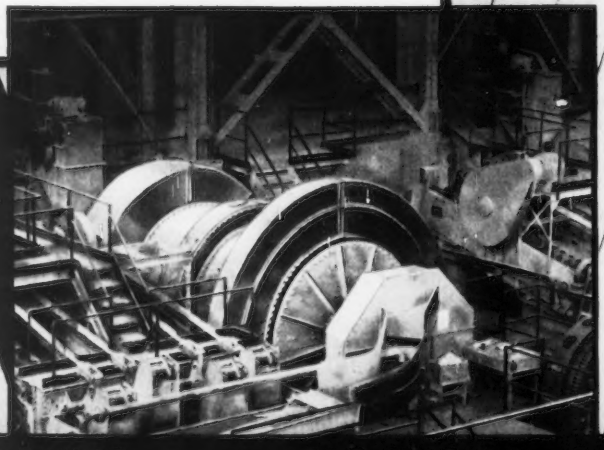

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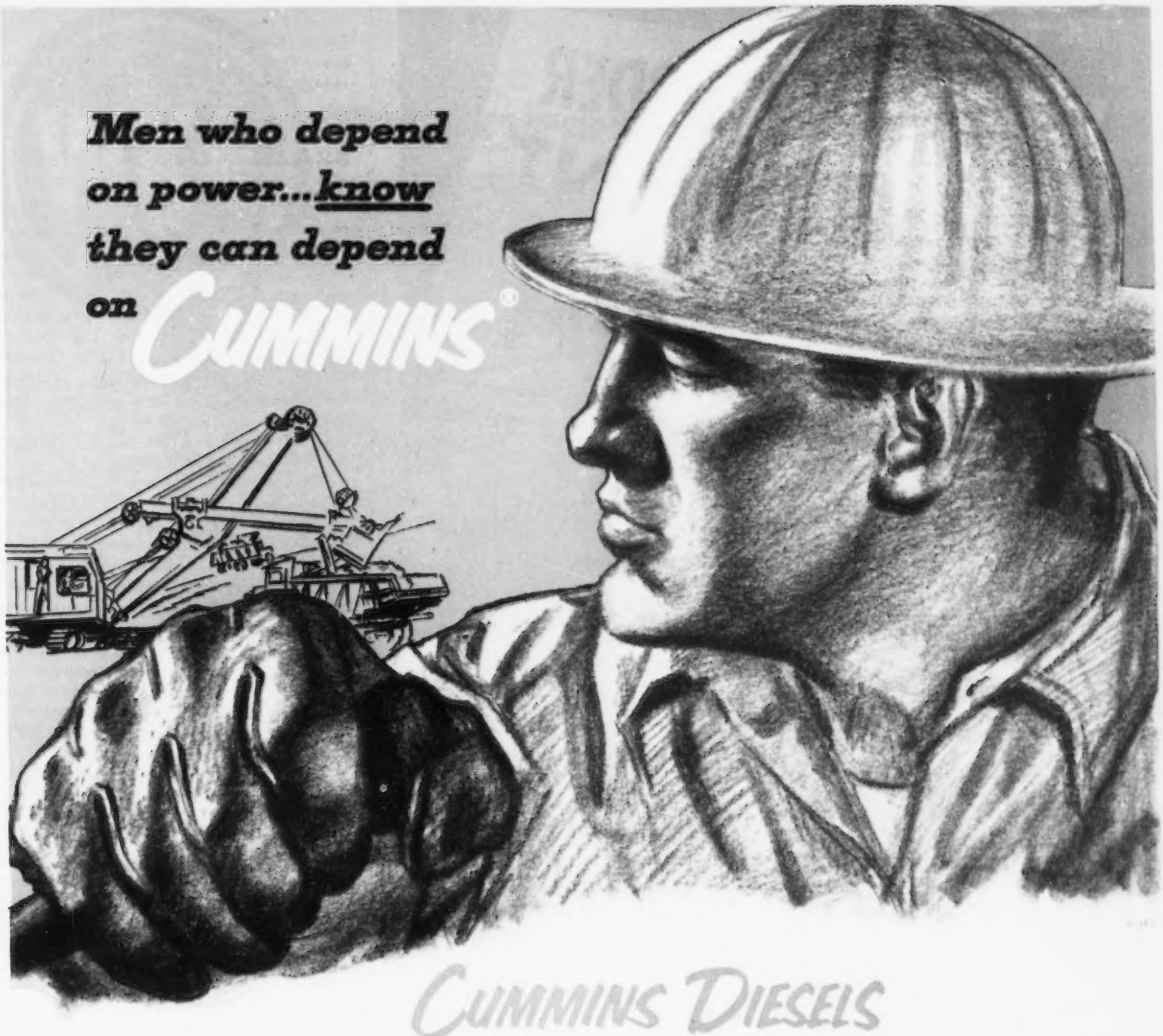

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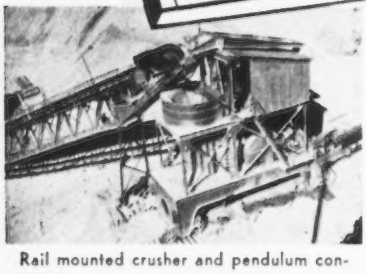
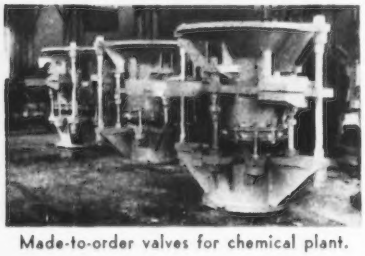
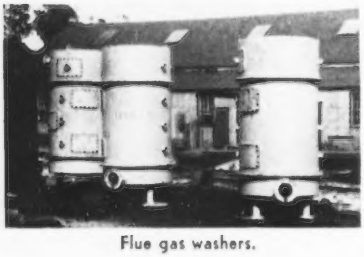


Rail mounted crusher and pendulum conveyor.



Made-to-order valves for chemical plant.



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Argentina *(Continued)*

under the current five-year plan. A blast furnace in the province of Juyjuy smelts the ore from the Zapala mines.

BRAZIL

Sulba Sociedade Comercial de Minerios, Ltd., Rio de Janeiro, subsidiary of Orquima Industries Quimicas Reunidas, S. A., is erecting mining and mineral separation plant near Barra do Itabapoama for production of monazite. Plans for the future include production of rutile, zircon, ilmenite in the separation. Carpco Engineering & Manufacturing Co., Jacksonville, Fla., is doing designing and engineering of the plant. At present the Brazilian company is using Humphrey spirals, high tension separators and induced roll separators. Carpco is now shipping two of its four-rotor and one two-rotor high tension separator units to the plant. When the plant is completed, it is said it will be the largest single producer of monazite in the world.

Cia Brasileira de Aluminio plans successive increases in aluminum ingot capacity from 10,000 metric tons at the close of 1953 to 50,000 tons by 1965. By 1957 capacity will be 15,000 tons.

Costs for the first stage of the program, to be completed this year are estimated at $20-million. This includes construction of an expandable plant at Aluminio, 47 mi. west of Sao Paulo. Power will be purchased until the company can build its own hydro station on nearby Rio Jaquia. Eventual total cost for full capacity is figured in the neighborhood of $50-million.

Reduction plant designs is the work of Italian metallurgists and features 30,000-amp. pots with removable bottoms. Italians were consulted because operating conditions in Italy are similar to those in Brazil.

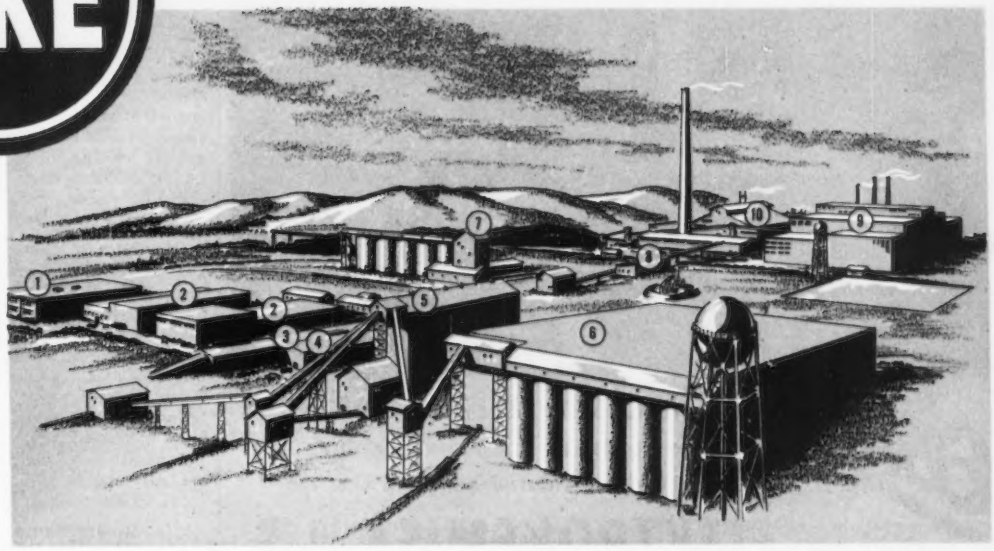
CBA will obtain high grade bauxite from its own extensive deposits at Pocos das Caldas some 225 mi. away. Newly constructed plants will supply petroleum coke for electrodes, and

CHILE

Chile Copper Co. Project: Underground copper mine, mill and smelter at Chuquicamata. Investment: $120-million. Grade of ore: 2.0%. Reserves; Not fully determined. Production rate: 30,000 tons sulphide ore per day; 250,000 tons copper per year. Capacity output: 1954.

Bethlehem Chile Iron Mines Co. Project: Iron mine at Coquimbo Province. Product: Iron ore. Grade: 62% iron. Production rate: 1-million tons per year. The development of the Romeral Mine, near La Serena, is a joint venture of the Compañía de

WKE Progress Report



ARTIST'S RENDITION OF WHITE PINE COPPER COMPANY INSTALLATION, WHITE PINE, MICHIGAN

White Pine Copper Project

75 million pounds of copper per year! That is the production expected from the new White Pine Copper Co. plant at White Pine, Michigan. This project represents a vital addition to the economic and industrial strength of America. To perform the design work for all mine, mill and smelter facilities, this important copper producer chose Western Knapp Engineering Company, a division of Western Machinery Company.

The following statistics — covering production facilities only — illustrate the tremendous scope of this project and convey some idea of the extensive design work for which WKE was responsible.

EXCAVATION	550,000 cubic yards
CONCRETE	44,000 cubic yards
REINFORCING STEEL	2,300 tons
STRUCTURAL STEEL	13,500 tons
CONNECTED HORSEPOWER	50,000
CRUSHING PLANT	14,280 sq. ft. floor space
CONCENTRATOR BUILDING	134,652 sq. ft. floor space
FILTER BUILDING	5,760 sq. ft. floor space
FLUX CRUSHING PLANT	4,840 sq. ft. floor space
SMELTER BEDDING PLANT	15,400 sq. ft. floor space
SMELTER BUILDING	52,800 sq. ft. floor space

These figures represent one more job well on its way to completion by WKE's top-flight design and engineering staff. Whether your job is large or small, a call on WKE puts at your disposal an experienced organization with competent personnel who know how to get the job done better and faster. And remember, too, that WKE is geared to handle a project in the way that best meets your needs. Metallurgical studies, engineering surveys, plant design, construction and initial plant operation — for all or any combination of these functions, you can rely on WKE.

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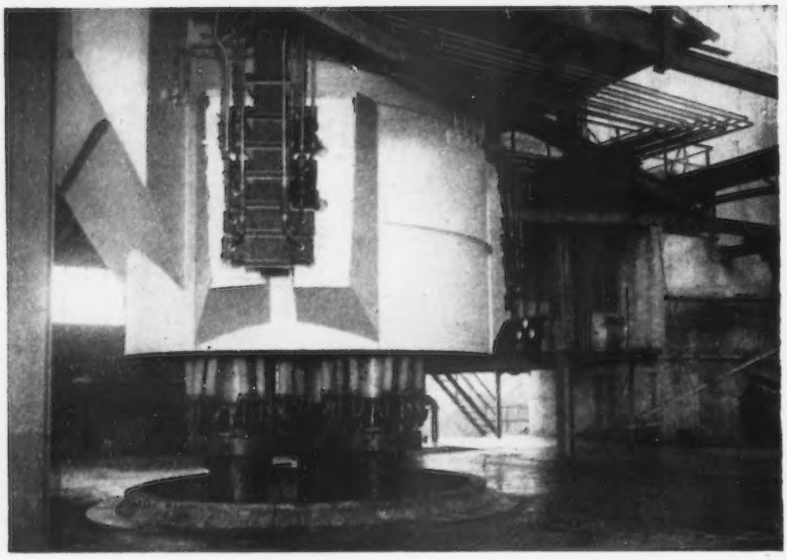

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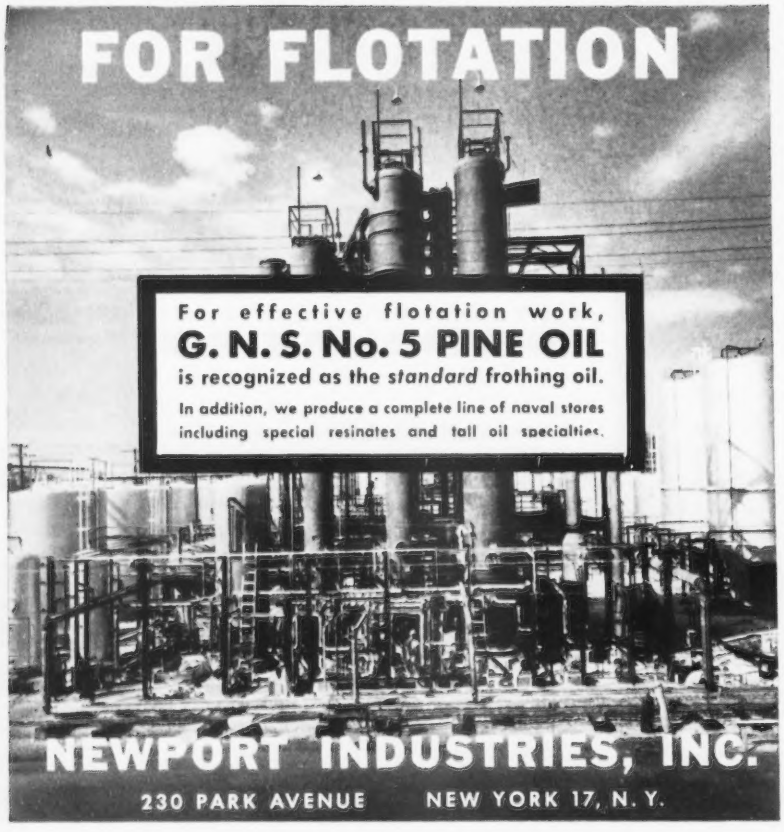
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Chile *(Continued)*

Acerco del Pacifico, the new steel mill built in Chile to produce 250,000 tons of steel a year, and the Bethlehem Chile Iron Mines Co., a subsidiary of Bethlehem Steel Co. The investment will approximate $12-million. The ore is largely magnetite assaying 62% iron. Production is planned for 1-million tons per year. The deposit will be mined by open-pit methods, and the ore will be sent 22.5 miles by railroad to the harbor at Guayacan Bay, south of the Port of Coquimbo. Here an ore-loading pier, 1600 ft. long is under construction. The orebody is said to contain 20-million tons of high-grade iron ore.

Cia. Minera Tamaya, subsidiary of Cia. Minera Punitaqui. Project: Preparations to re-open copper mine at Tamaya. Grade of ore: 2% copper.

Cia. Minera Aysen, subsidiary of Cia. Minera Punitaqui. Project: Mine and mill at Punta Cristal, Province of Aysen. Production started in 1952, and today the company is exporting 400 tons of high-grade zinc concentrates per month, and 200 tons of lead concentrates per month. Assured reserves total 40,000 tons of lead-zinc ore.

Cia. Minera Santa Fe. Project: Iron mine at Klieto and Zapallo, province of Coquimbo. This new iron mine started production in late 1952, selling 60-65% hematite to U. S. Steel Co. The firm has just requested $5-million to expand operations.

Compañia Acero del Pacifico, the new steel mill built near Concepción in southern Chile, produced 266,000 short tons of steel billets and 270,000 short tons of pig iron last year, most of which was converted into steel. Coke is made out of a mixture of American and Chilean coals and the iron ore is supplied by the El Tofo mine in Coquimbo Province, which is worked by Bethlehem Chile Iron Mines Company, a subsidiary of Bethlehem Steel Corporation. Net profit in 1952 amounted to $3,500,000. This steel mill was built to supply most of Chile's needs in steel products which previously were imported from the United States or Europe. As far as Chilean raw materials are concerned, the steel mill consumed 250,000 short tons of coal, 495,000 short tons of iron ore and 126,000 short tons of limestone in 1952. It was able to export, after supplying the internal needs of the country, iron and steel products worth $7,300,000.

In his speech delivered before Congress on May 21 on the state of the nation, the President, Señor Carlos Ibañez del Campo, made it absolutely clear that he will not allow the Communist party to interfere with production by trying to gain control of the labor unions. This can be taken as a final decision that the law known as Defense of Democracy will not be repealed.

(Continued on page 248)

NEW U-1091 natural gas power unit develops 187 net h.p. at 1400 rated r.p.m.; 200 net h.p. at 1600 max. r.p.m.; maximum torque, 820 lbs. ft. @ 800 r.p.m.

NEW, Power-Packed AND READY TO GO!

NEW U-450—102 net horsepower at 1800 rated r.p.m.; 110 @ 2200 r.p.m.; maximum torque, 324 lbs. ft. @ 1200 r.p.m.

NEW U-406—91 net horsepower at 1800 rated r.p.m.; 98 @ 2200 r.p.m.; maximum torque, 279 lbs. ft. @ 1200 r.p.m.

NEW U-372—83 net horsepower at 1800 rated r.p.m.; 91.5 @ 2200 r.p.m.; maximum torque, 263 lbs. ft. @ 1200 r.p.m.

NEW U-269—62 net horsepower at 1800 rated r.p.m.; 72 @ 2400 r.p.m.; maximum torque, 191 lbs. ft. @ 1200 r.p.m.

NEW U-240—55 net horsepower at 1800 rated r.p.m.; 64 @ 2400 r.p.m.; maximum torque, 168 lbs. ft. @ 1200 r.p.m.

NEW U-220—50.5 net horsepower at 1800 rated r.p.m; 62 @ 2400 r.p.m.; maximum torque, 151 lbs. ft. @ 1200 r.p.m.

IH Announces Seven New International Engines

Seven new six-cylinder, carbureted, valve-in-head engines have been added to the International line, which now includes 18 models—diesel, gasoline or gas—ranging from 16.5 to 200 net horsepower.

These new models are the result of more than 45 years of IH engineering and manufacturing experience building a complete line of heavy duty engines for tractors, trucks, construction and oil field equipment and individual power unit applications.

These new units have the durability, flexibility and economy to meet your requirements for lower cost performance. The unmatched network of IH district offices, parts depots, distributors and dealers puts complete service facilities practically at your door.

If you are an individual user of engines, it will pay you to see your nearest International Industrial Distributor or Power Unit Dealer for more complete information. If you are a manufacturer, your nearest IH district office will be glad to help you engineer these engines into the equipment you are building.

INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILL.

POWER THAT PAYS — **INTERNATIONAL**

BROAD CRAWLER TREADS ENABLE G-E SHUTTLE CAR TO EASILY NEGOTIATE SOFT OR WET BOTTOMS, EVEN WHEN FULLY LOADED

New G-E Shuttle Car Proving Ideal for All Types of Mining Conditions

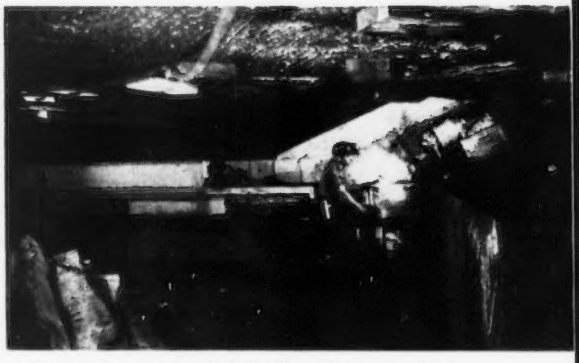
Low ground pressure, greater maneuverability, lower maintenance costs made possible with crawler treads

Using crawler treads instead of rubber-tired wheels, the new General Electric shuttle car is proving its efficiency and versatility under all types of mining conditions. Fully loaded, the car has only 20 pounds per square inch ground pressure. With a 14 to 16 foot turning radius, the car is ideal for operation where tunnels are narrow and turns are sharp. The wide conveyor, which is made possible by the use of crawler treads and the absence of wheel-wells, increases carrying capacity up to 300 cubic feet (with 12-inch sideboards).

The G-E shuttle car is simplicity itself in design and ease of operation. All motors and controls, though well-protected from abrasive materials and meeting U.S. Bureau of Mines' specifications, are easily accessible for servicing and maintenance.

Whatever mining conditions you face—no matter how rigorous they are—the new G-E cable-reel track-laying shuttle car can meet your requirements of service and economy. For complete information contact your nearest G-E sales office. General Electric Company Schenectady 5, New York. 120-65

1878 75 1953 YEARS OF ELECTRICAL PROGRESS



Only 42 inches high, the G-E shuttle car has a carrying capacity 30 per cent greater than cars of conventional design. Car above, at Jamison Coal and Coke Co., Hostetter, Pa., shows simplicity of unloading in tight quarters.

You can put your confidence in—

GENERAL ELECTRIC

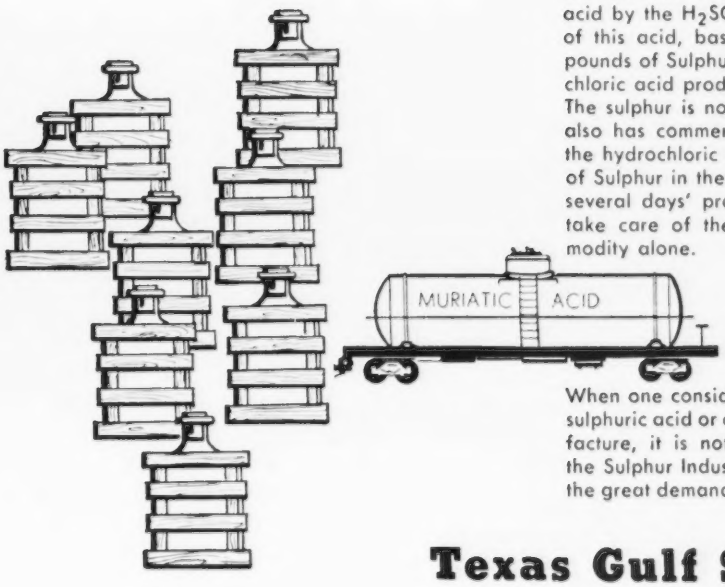
Sulphur

Loading a ship with Sulphur at Galveston

Thousands of tons mined daily, but where does it all go?

PARAPHRASING an old saying: 'It takes a chemical to make a chemical,' certainly applies to hydrochloric acid.

No chemical engineer has to be told how hydrochloric acid is made but sometimes with the mind focussed on the word "hydrochloric" little thought is given to another word "sulphuric." It is this word that calls attention to the fact that to make one net ton of 20° Bé hydrochloric acid by the H_2SO_4 process requires about 950 pounds of this acid, basis 100%, which is equivalent to 320 pounds of Sulphur. About one third of the annual hydrochloric acid production is made by the use of sulphuric. The sulphur is not lost because salt cake, a by-product, also has commercial value. But any way you figure it, the hydrochloric acid industry is an important consumer of Sulphur in the form of sulphuric acid. In fact, it takes several days' production from all the Sulphur mines to take care of the annual production of this one commodity alone.



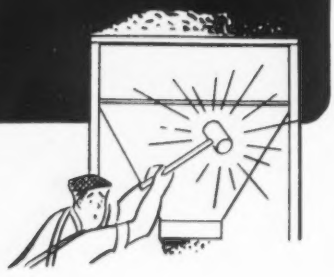
When one considers all the other chemicals that require sulphuric acid or other Sulphur compounds for their manufacture, it is not difficult to appreciate how faithfully the Sulphur Industry is serving industry today in spite of the great demands made upon it.

Texas Gulf Sulphur Co.

75 East 45th Street, New York 17, N. Y.

Mines: Newgulf and Moss Bluff, Texas

BIN
STUCK LATELY?



Don't ruin your bins with a heavy hammer. Just use a CLEVELAND vibrator to eliminate arching, bridging or sticking conditions. Many successful installations on bins, hoppers, chutes of all sizes and shapes.

Air cushioned quiet types and standard metallic impact vibrators.

Save with air!

CATALOGS AVAILABLE, OF COURSE.

THE CLEVELAND VIBRATOR COMPANY

2834 Clinton Ave. • Cleveland 13, Ohio

Chile *(Continued)*

The Executive Vice President of the Mining Bank, in a signed exposition published by the press, made it known that the Bank had not been able to sell the blister produced by the Paipote smelter during the months of March, April and May and that he hoped that soon the Central Bank would take a decision that will enable his organization to sell not only such production but also that corresponding to the rest of the year. He said that the Mining Bank's inability to sell the Paipote blister had caused a temporary shortage of cash and that this was the reason why there was not sufficient money at the Bank's numerous ore buying depots to pay promptly all the ore delivered by the miners. He estimated the Bank needed at least 400-million pesos or $3,650,000 at the official rate of exchange of 110 pesos to the dollar to be able to pay for the ores and metallic gold as soon as these are delivered, sampled and assayed at the depots.

He referred also to a bill which the Secretary of the Treasury will soon send to Congress asking for 1,200-million pesos, or about $10-million, to help the small miners. Among the most pressing needs of the industry, he mentioned the development of mines that could work with low copper prices, because of mechanization, so that such mines could supply the Paipote smelter with all the concentrates it needed so as to keep it working at full capacity under a recession; to improve railroad transportation in the provinces of Coquimbo, Atacama and Antofagasta and unloading facilities at the port of Caldera serving the smelter; the building of a sulphuric acid plant and a leaching plant for oxide copper ores at the Paipote smelter, and the construction of an electrolytic refinery to handle the Chuquicamata and Paipote blister.

COLOMBIA

Manuel M. Mosquera, prominent civil engineer, has recently discovered copper ore in Valle del Cauca. Vein samples ran 20% copper with values of silver and gold. Exploration is now going on at depth.

Industrias Puracé, managed by Manuel Mosquera, has been exploiting sulphur deposits on the Puracé Volcano near Popayan. Present production is about 300 tons of refined sulphur per month. Steam-operated autoclaves are used. To increase production, Industrias Puracé has contracted with Chemical Construction Co., of New York, for a new plant to produce sulphur. The plant has been under construction since August 1952. Capacity of the plant is 1,000 metric tons of refined sulphur per month. Costs up to now have totaled about $360,000 (US).

Empresa Siderurgica Nacional de

CONNELLSVILLE
(LEPLEY)
Safe MINING EQUIPMENT

Economical-Rugged!

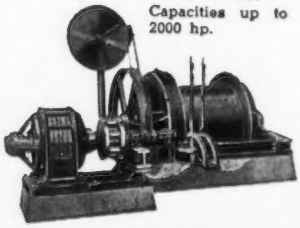
MAN CAGES
Single or double deck types. Capacities from 1 to 90 men.

BOTTOM DISCHARGE SKIPS
Built to "take it" in 1 to 25 ton capacities.

SKIP LOADING CHUTES
Operated either by skips or air cylinders. Toggle locked when closed.

SHEAVES
Bicycle type with renewable special steel liners. Up to 16 ft. dia. with plain or anti-friction bearings.

ELECTRIC HAULAGES
Capacities up to 2000 hp.



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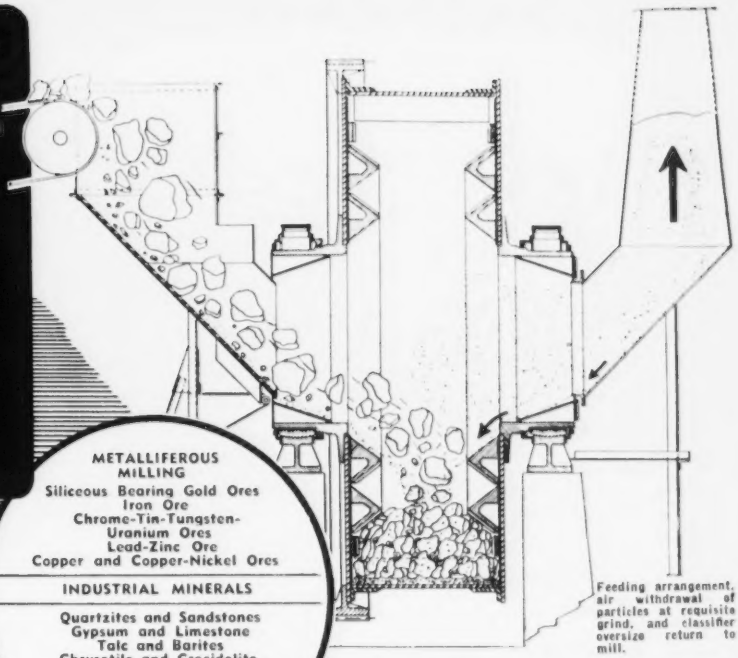
We specialize in all types of equipment to meet your needs

CONNELLSVILLE
MFG. & MINE SUPPLY CO.
CONNELLSVILLE, PA.
"Serving the Mining Industry Since 1901"

Here is the METALLURGICAL and COST DATA on the new "AEROFALL" MILL



Feeding arrangement, air withdrawal of particles at requisite grind, and classifier oversize return to mill.

The Aerofall Mill is a dry, combined crushing-grinding unit, capable of taking run-of-mine minus 18" size material and reducing it in a single operation to as fine as 99.0% minus 325 mesh. For a coarse grind, it will produce a product in the 6 mesh range. It will tolerate a moisture content of 3½ to 4% without affecting either capacity or product, and up to 25% moisture by dual treatment.

METALLIFEROUS MILLING

Siliceous Bearing Gold Ores
Iron Ore
Chrome-Tin-Tungsten-Uranium Ores
Lead-Zinc Ore
Copper and Copper-Nickel Ores

INDUSTRIAL MINERALS

Quartzites and Sandstones
Gypsum and Limestone
Talc and Barites
Chrysotile and Crocidolite Fibres
Ferrosilicon
Various Types Pot Linings
Feldspars
Artificial Abrasives

• **Illustrating** The crushing action in the base of the mill.

CHART

ILLUSTRATIVE COMPARISON OF AEROFALL MILL CIRCUIT versus CURRENT STANDARD CIRCUIT IN THE BENEFICIATION OF LOW GRADE IRON ORE SHOWING COMPARATIVE COSTS AND METALLURGICAL RESULTS.

Note: The current standard circuit consisted of primary crushing followed by three stages of cone crushers, followed by rod mill, and then ball mill.
The Aerofall Mill circuit consisted of primary crusher followed by the Aerofall Mill producing the final product.

Comparative Metallurgy:

	Current Standard Circuit	Aerofall Circuit
Head Sample — % Fe	23.0	23.0
Grade of Concentrate — % Fe	61.5	67.0
% Fe Recovery	94.0	98.8
Grind Analysis:		
Current standard circuit		25% minus 325
Aerofall circuit		19% minus 325
Comparative Comminution Costs:		
Current standard circuit		$ 0.26/Ton
Aerofall circuit		$0.065/Ton

In the Aerofall Mill, the material itself is normally the total charge. This mill uniquely combines the comminution action of (1) abrasion, (2) blow impact, and (3) drag. Product is collected in either wet or dry type cyclone.

The Aerofall Mill produces not only a more uniform grind, but will also give, when required, a "differential grind"—meaning that minerals can be handled with minimum of breaking down of their individual crystals, thus resulting in outstanding improvements in metallurgical results. The above drawings illustrate the design of the Aerofall Mill, showing its various actions and why there is a minimum of "slip," with maximum energy devoted to actual comminution at high speed, making for increased operating economies, as shown in the above illustration. In short, the Aerofall Mill represents, in results and in low costs, a revolutionary development in general milling practice, and merits your further careful investigation.

Complete data sent on request

AEROFALL MILLS, LTD.

129 ADELAIDE ST. WEST TORONTO 1, CANADA

Makes Tubing Installation a *Breeze!*

One man can easily hang 100 feet of ABC Mine-Vent Tubing an hour. Here's why: Mine-Vent's patented snap-on couplings take only seconds to join sections . . . the joint is airtight. To hang Mine-Vent, simply string a messenger wire along roof, wall or timbers, slip Mine-Vent's simplified hangers into the tubing and attach to the wire.

The result is cooling fresh air brought to the working face as fast as the work progresses—with less time and effort to get it there. For improved ventilation at less cost write **AMERICAN BRATTICE CLOTH CORP., 220 Buffalo Street, Warsaw, Indiana.**

"Canned" for your convenience

Durable, easy-to-handle fiber drums keeps Mine Vent in perfect condition until you need it

Mine-Vent Tubing

Colombia *(Continued)*

Paz de Rio. Steel plant to treat iron ores from Paz de Rio. Capacity: 122,000 metric tons of steel per year. The plant will use the Thomas process because of the high phosphorous content. Iron ore reserves have been reported as follows: 120-million tons of blocked out ore, and an additional 30-million tons of probable ore. Grade of ore: 48.3% iron, about 1% phosphorus. Progress: Mining will begin in 1954.

CUBA

Freeport Sulphur Co. Project: Nickel-cobalt mine and treatment plant at Moa Bay. Investment: $20-million. Product: Nickel and cobalt. Grade of ore: 1.35% nickel, 0.14% cobalt. Start of production: 1955. Size of orebody: Estimated to contain 40-million tons. Process: Chemical Construction Co. sulphuric acid leaching process in collaboration with Freeport Sulphur Co. metallurgists. Output of the plant has been set tentatively at 30-million lb. of nickel and 3-million lb. of cobalt yearly.

Cuba is also the scene of some very active exploration projects which may materialize into producing mines in the near future.

MEXICO

American Smelting & Refining Co. Project: Coahuila flotation plant. Investment: $40,000. Product: Fluorite. Production rate: About 200,000 tons per year. Grade of ore: 82% CaF_2. Progress: Plant under construction.

Impulsora de Minera S.A. Project: Tungsten mill at El Slato de Maguey near Guanajuato, Mexico. Investment: $115,000. Product: Tungsten concentrates. Grade of ore: 0.8% WO_3. Production rate: About 180,000 tons per year. Progress: Mill is being completed. Machinery imported from Denver.

Impulsora de Minera, S.A. Project: Copper flotation mill at Somberete, Zacatecas. Investment: $100,000. Product copper, zinc, silver, tungsten in concentrates. Rate of mill: 150 tons per day. Grade of ore: 2% lead, 6-10% zinc, 500 grams silver. Progress: Plant now under construction.

Edmundo Villareal. Project: Zinc fuming plant at Monterrey. Investment: $1-million. Product: Zinc oxide from zinc carbonate ores. Progress: Plant is under construction. Machinery is imported from the U.S. Starting date: 1954.

Muzquis, Coah. Project: Fluorite plant. Cost: $200,000. Product: Fluorite. Grade of ore: 82% CaF_2. Progress: Plant started up recently. Heavy Media takes off acid grade which then goes to flotation section which produces an acid-grade concentrate.

Puts fresh air where you want it—*Anywhere*

Mine-Vent Tubing is made to go anywhere that fresh air is needed . . . with fittings available for every conceivable coursing dip, curve or bend. Yet, Mine-Vent is easy to move: Patented snap-on couplings and simplified hangers will save you countless hours of installation time. One man can hang 100 feet of Mine-Vent an hour with ease. with flexing.

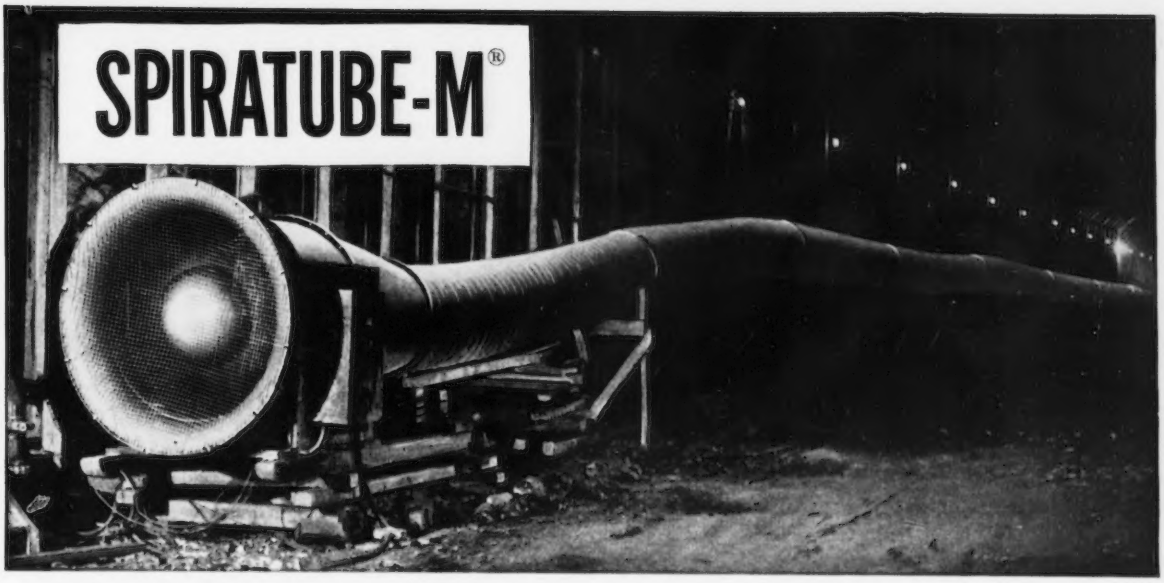
Write us your ventilation needs . . . now.

AMERICAN BRATTICE CLOTH CORP., 220 Buffalo St., Warsaw, Indiana

"Canned" for your convenience

Durable, easy-to-handle fiber drums keeps Mine Vent in perfect condition until you need it

Mine-Vent Tubing



Simplify mine and tunnel ventilation

Here's the airduct that can take it! Now you can deliver air to the working face of mine or tunnel — cheaper! That's because SPIRATUBE-M is built to cut maintenance costs! Ease of handling reduces installation costs. Unique SPIRATUBE-M construction features minimize leaks and seepage. And you get the maximum efficiency of your blower or fan . . . cutting power costs!

Immediately available in diameters to 30 inches, from fully-stocked distributors, SPIRATUBE-M is made in tough high count fabrics, all specially treated and heavily coated inside and out to withstand fungus, mildew and rough treatment.

And, patented, *built-in*, quick-couplers eliminate the need for separate parts . . . no need to look for couplers when you're in a hurry.

For heavy duty, pressure ventilation tubing without wire reinforcement, ask for AYRTUBE®. Sold in diameters to 36", AYRTUBE by itself or in combination with SPIRATUBE-M offers you an inexpensive airducting.

Check these features:

Handling ease

Lightweight

Flexible

Easily installed by you

Takes sharp turns without crimping

Withstands fungus, mildew, rough treatment

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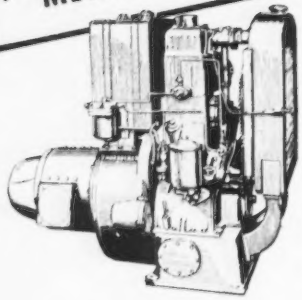
NO EXPERIENCED MECHANICS NEEDED



. . . NORDBERG DIESEL ENGINES are easy to operate—simple to maintain

You just don't need special mechanical training to operate and maintain Nordberg "4FS" Diesel engines.

Their basic design and construction makes them easy to start and easy to keep going—day in, day out, with a minimum of attention. Routine maintenance is extremely simple . . . all parts are easy to get at.

These are reasons why Nordberg 1, 2 and 3-cylinder "4FS" Diesels are more and more in demand for all kinds of power jobs from 10 to 45 hp—for electric service from 6 to 30 kw (6,000 to 30,000 watts)—and for pumping jobs from 200 to 3000 gpm at 15 to 240 ft. total head.

Mail the coupon for full details.

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Send catalog covering Nordberg Type 4FS Diesels. I am interested in a unit for the following service: EM

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VENEZUELA

Venezuela's great iron deposits. The first iron ore shipment left Venezuela for the United States in March 1951 thereby starting the nation off on its way to becoming one of the great iron ore producers of the world. Exports rose to 2-million tons in 1952, and are expected to increase until they reach a steady volume of 10-million tons by the end of 1954. Bethlehem Steel Co. showed interest in Venezuelan iron ore in 1933 resulting in construction and development which was completed in 1950. To date Bethlehem has invested $40-million in the El Pao development including a 40-mile railroad from El Pao to the Port of Palua.

U.S. Steel Co.'s subsidiary, Orinoco Mining Co., has spent some $150-million in developing the famous Cerro Bolivar deposit. Actual exports of iron ore from this source are expected in 1954.

In all, iron ore companies in Venezuela have concessions covering an area of 139,999 acres or approximately 0.2% of national reserve zones for iron ore exploration which total 68,723,220 acres. Proven reserves to date of high grade iron ore (57 to 65% iron) total 632,174,000 tons in the concession of the iron ore companies, and 407-million tons in the reserve area. Above this there is an estimated 550-million tons of high grade ore which has not been thoroughly investigated. Recently the Ministry of Mines undertook an aeromagnetic survey of part of the reserve zone, and technicians are now evaluating the data recorded.

Asbestos. Concessions belonging to C.A. Minas de Anianto de Tinaquillo in Cojedes State produced about 333 metric tons last year. Commercial possibilities of other asbestos deposits are now being studied.

Sulphur. Large-scale sulphur possibilities in the region of El Pilar have prompted the Venezuelan Sulphur Co. to plan a sulphur refining plant to produce 250,000 tons of 95% sulphur per year.

Phosphate Rock. Extensive exploration in Cerro Riecito, Falcon State, indicate some 15-million tons of high-quality phosphate rock.

Nickel. Extensive deposits of low-grade nickel ore have been found in Miranda and Aragua states. Compania Meridionel de Minas, S.A., subsidiary of International Nickel Co. has concessions here, and is working on a process to extract nickel economically. The nickel occurs mainly as a silicate.

Gold. The Venezuelan Government has acquired the old Guayana Mining Co., and is installing modern equipment at this property.

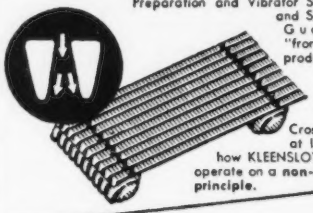
Manganese. A company has been

(*Continued on page 258*)

Kleenslot
WEDGE-WIRE PREPARATION SCREENS

FOR DEWATERING, SIZING AND SCREENING OPERATIONS

The mining industries can't afford to overlook this product. Accurate openings, great strength, long life and economy makes WEDGE-WIRE Preparation and Vibrator Screens and Screen-Guards "front line" products.



Cross section at left shows how KLEENSLOT Screens operate on a non-clogging principle.

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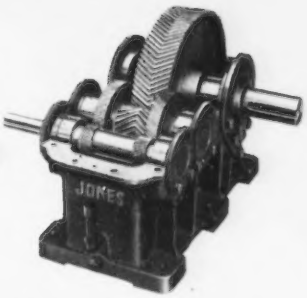
Let us quote on your requirements

FILTER FABRICS, INC.
704 MARION BUILDING
CLEVELAND 13, OHIO

One of two new Allis-Chalmers kilns at Basic Refractories Inc. Maple Grove, Ohio plant. Dual drives engineered by Allis-Chalmers Mfg. Co. and W. A. Jones Foundry & Machine Co.



Driving a non-stop giant size rotary kiln calls for PLUS PERFORMANCE

That's why Basic Refractories selected JONES HERRINGBONE GEAR SPEED REDUCERS to drive two new rotary kilns — the largest in the world's refractory industry — at their Maple Grove, Ohio dolomite processing plant.

Operations at Basic are continuous. In processing, dead burned dolomite must be constantly *ON THE MOVE* — a drive failure could result in serious damage from the hot mixtures in the kiln.

Naturally, Basic Refractories' engineers took utmost care in the drive component selection for this important application. And, naturally, they chose JONES HERRINGBONE GEAR DRIVES because of their proven ability to stay on the job and take the 'round-the-clock, day-in and day-out punishment of continuous operation.

Giving PLUS PERFORMANCE under these and similar conditions is nothing new for any type Jones Speed Reducer — all are recognized and accepted throughout industry for all sorts of applications demanding rugged dependability, maximum capacity and quiet, smooth, power transmission.

BIG DRIVES — SMALL DRIVES — You may not have a giant kiln to drive; but when you have a power transmission job, big or small or anything in-between, your best answer is JONES . . . it has been for over 60 years.

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CAST IRON PULLEYS • CUT GEARS • V-BELT SHEAVES
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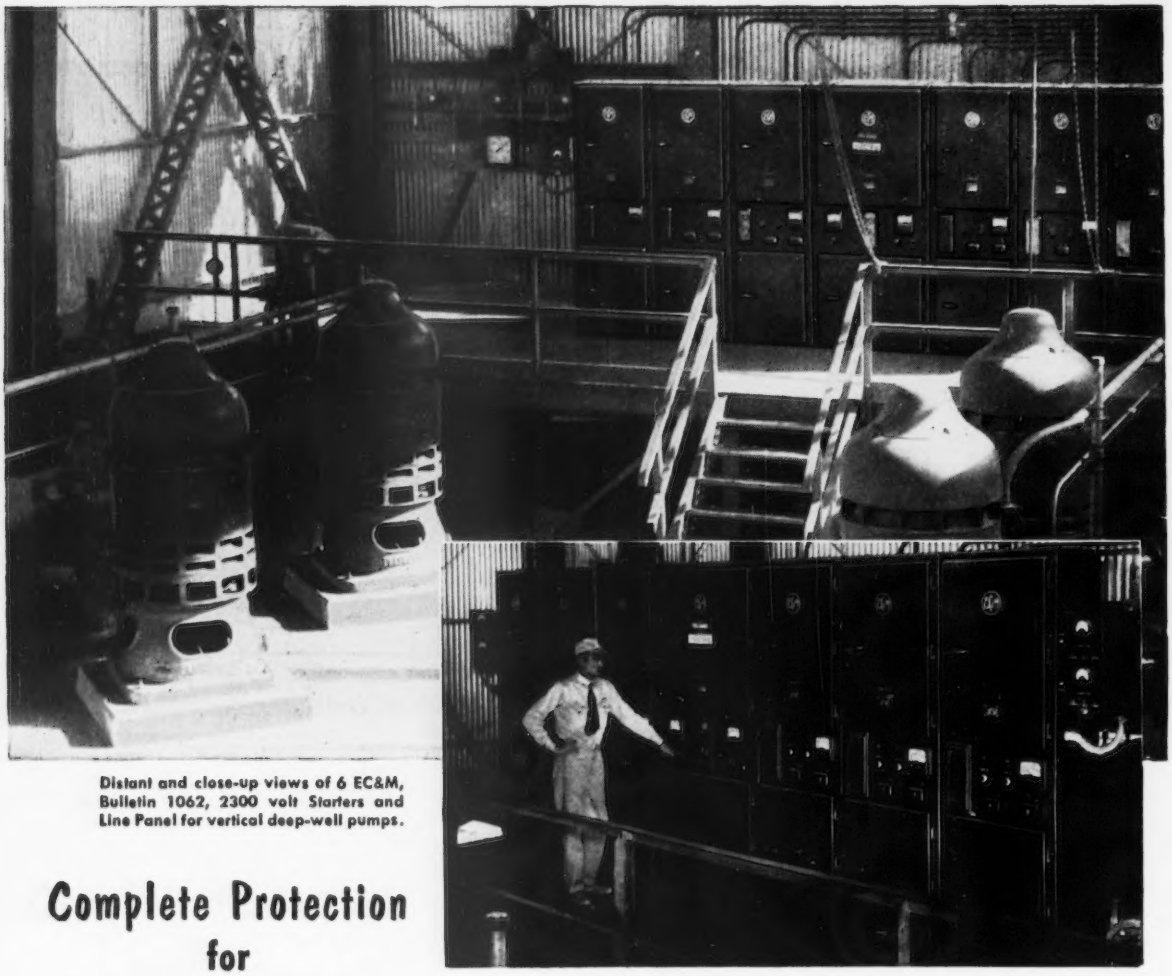

Distant and close-up views of 6 EC&M, Bulletin 1062, 2300 volt Starters and Line Panel for vertical deep-well pumps.

Complete Protection for ESSENTIAL DRIVES BY EC&M 2300 VOLT STARTERS

When plans call for 2300 volt power, the motor drives connected to this source take on added importance—they are generally considered "main-line" and highly essential to a plant's output. Such drives deserve "all-out" protection and EC&M Type ZHS 2300-4600 volt Motor Starters are designed to provide it.

Illustrated above is a typical installation of these EC&M Starters. Main line contactor is the well-known Type ZHS Magnetic Contactor having high interrupting capacity—ability to provide frequent starts and stops with only routine inspection. Front cubicles are the aligning type; self-contained bus is an optional feature. Safety door interlocks open the contactor circuit and avoid pulling disconnect switches under load. Push button starting brings each motor up to speed with greater skill than human hands could do it.

When making initial cost estimates, get the facts on EC&M High Voltage Starters. Our nearby office will be glad to supply full information on starters which give complete protection.

WRITE FOR BULLETINS 1062 and T9-117 reprint.

THE ELECTRIC CONTROLLER & MFG. CO.
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FOR MAXIMUM RECOVERY

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This low-cost flotation agent is an excellent frother for sulfide minerals such as the zinc, copper, nickel, iron, and lead sulfides. It is widely used in the flotation of gold ores and native metals. Yarmor F is also an excellent frother for use in the beneficiation of nonsulfide ores such as coal, mica, quartz, graphite, feldspar, phosphate rock, and talc.

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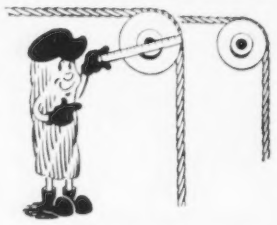
Shovel and Dragline Operators

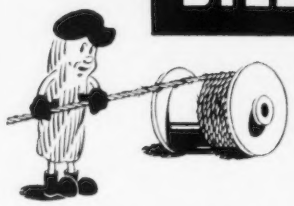
do you want to cut operating costs?

J&L STEEL

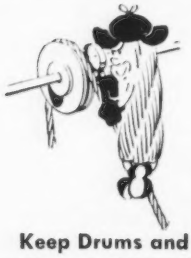
Here are a few tips on longer Wire Rope Service Life!



Avoid Small Drums and Sheaves

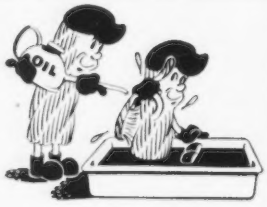


Keep Lines from Rubbing

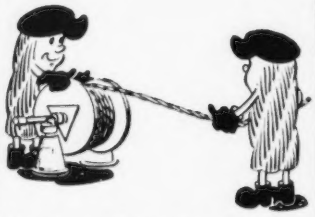


Keep Drums and Sheaves Aligned

Check Your Sheave and Drum Grooves



Lubricate Your Lines Regularly



Use Jacks When Transferring Lines from Reel to Drum

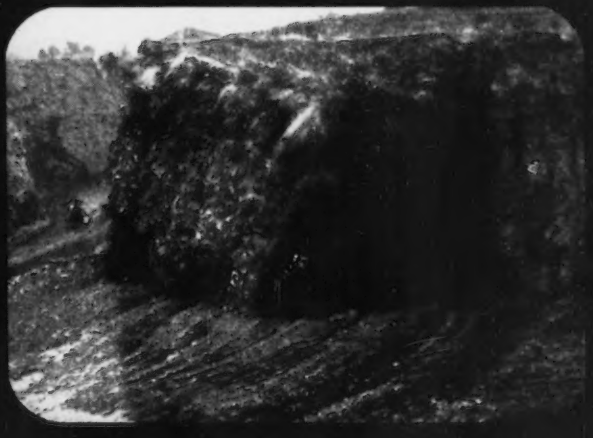
SPECIFY J&L WIRE ROPES FOR YOUR EQUIPMENT

Proof of the value of any wire rope lies in its performance on the job. The unexcelled performance record of J&L Wire Ropes can be traced to J&L's *quality control* method of manufacture. *Quality control* that ensures the finest finished product by regulating every step in the manufacture of wire rope from the mining of iron ore to final stranding and closing operations. The result is wire rope that provides maximum service life—helps keep your operating costs to a minimum by cutting down time for re-rigging and making possible maximum production per wire rope dollar.

If you're not already using J&L wire rope, why not contact your nearest J&L representative *today*.

JONES & LAUGHLIN STEEL CORPORATION
PITTSBURGH 30, PA.

Here's how ROCKMASTER® blasting increases explosives efficiency



You can see ROCKMASTER efficiency in these pictures, taken at the height of four different ROCKMASTER blasts. There is no flying rock, no geysering of explosive force. ROCKMASTER keeps the power of the blast confined, using all the explosives energy to produce maximum breakage with maximum efficiency.

When the blast is initiated at the point of maximum confinement, the explosive force follows the line of least resistance . . . directly into the burden. With ROCKMASTER millisecond blasting, the first initiation places the burden under maximum stress, producing lines of weakness throughout the burden. A split-second later, the next charge hits the stressed material with a shattering force that produces maximum breakage . . . maximum use of the explosive force. It is the "one-two punch" applied to blasting.

Ask your Atlas technical representative to show you the picture presentation of the ROCKMASTER story. See for yourself how the millisecond delay electric blasting caps teamed with the ROCKMASTER system of explosives choice can give you greater blasting efficiency through complete confinement of the blast.

ATLAS

ATLAS EXPLOSIVES

"Everything for Blasting"

ATLAS POWDER COMPANY
WILMINGTON 99, DELAWARE

Offices in principal cities

"THIS LUBRICANT CUT OVERHAULS IN HALF"

—says WESTERN AUTO TRANSPORTS, INC.

"Operating over 200 tractors and 200 trailers from Detroit to the West Coast, we encounter temperatures from 120° above across the desert to 40° below in the mountains of Colorado. We have found that with LUBRIPLATE our wheel bearing packing mileage has tripled. Since using Lubriplate A.P.G.-90 in our transmissions and differentials, we are getting double the mileage between their overhauls."

For nearest LUBRIPLATE distributor, see Classified Telephone Directory. Send for free 56-page "LUBRIPLATE DATA BOOK"... a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE COSTS.

Venezuela *(Continued)*

formed to extract manganese from deposits south of El Pao.

Bauxite: Discovery of significant bauxite deposits, in Upata, running as high as 60% Al_2O_3, and averaging about 48%, has led mining authorities to consider development of an aluminum plant to be run on power from the proposed Caroni River hydro-electric plant.

PERU

Compania Minera Posco, S. A. Project: Cyaniding plant for treatment of gold ore. Investment: $1.3-million. Grade of ore: 30 grams gold per ton.

Compania Minera Posco, S. A. Project: Cyaniding plant for treatment of gold ore, in province of Caraveli, Arequipa. Investment: $1.3-million. Grade of ore: 30 grams of gold per ton. Starting date: Late 1953.

Minas Venturosa. Project: Adaptation of concentrating plant for copper, lead, zinc and silver—in Lima. Investment: $650,000. Grade of ore: 1.7% copper, 5.6% lead, 6.1% zinc and 8.6 oz. silver. Production rate: 180 tons per day. Starting date: 1953.

Eugenia Gold Mines Co. Project: Cyaniding plant for treatment of gold ore in Caraveli, Arequipa. Investment: $900,000. Grade of ore: 18 grams of gold per ton. Capacity: 60 tons per day. Starting date: July 1953.

Compania Minera Marcona. Project: Open-pit iron mine in San Juan, Ica. Investment: $65-million. Reserves: 100-million tons of iron ore. Company will supply Peruvian steel plant at Chimbote, which is not yet in operation. First shipment of 10,000 tons of ore made to U. S. Steel Co. at Sparrow Point, Md., on April 30, 1953. Ore going straight from open pit, by truck and conveyor belt to steamers.

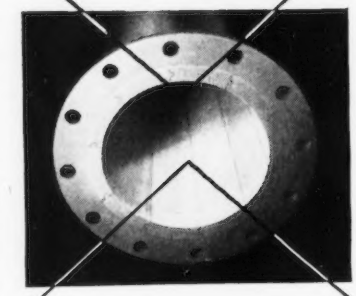
Cerro de Pasco Corp. Project: Zinc Development program. Investment: Total cost will be $44-million; $21-million expended to date; $24-milion will be expended over the next three to three and one-half years. Progress: Concentrating facilities at Paragsha enlarged, 35-ton electrolytic refinery completed. First 35-ton unit of a 200-ton Sterling process electrothermic plant nearing completion, a second 35-ton unit scheduled for next year, with more to follow.

IN EUROPE

CYPRUS

Ezperanza Copper and Sulphur Co. Project: Open-pit mine and mill. Investment: $1½-million. Products: Sulphur (pyrite), gold, copper, silver. Grade of ore: Gold, $57 per ton. Pro-

there is NO substitute . . .



MPC WOOD-LINED PIPE MEETS ALL THE REQUIREMENTS FOR A DEPENDABLE MINE PIPE

COMBINES THE STRENGTH OF STEEL WITH THE DURABILITY OF WOOD

MPC Wood-Lined Steel pipe is ideally suited for acid mine waters, culm, and slurries to pressures up to 400 psi. The wood lining, made of clear redwood, Douglas fir, or pine staves, is offered in thicknesses from 11/16" through 3", while the outer carbon steel shell is available from 14 gauge through schedule 80 thickness. Flanges, welded to the pipe, carry ratings of 125 lb. upwards, with A.S.M.E. bolt circle or special drilling. Pipe sections 10' and 20' regular lengths or fabricated to suit. Internal diameters 4" through 48". Pipe exteriors protected against corrosion. Wood-lined fittings available for all diameters in standard and special designs.

Get in touch with your MPC representative or write Dept. EMJ

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MICHIGAN PIPE COMPANY

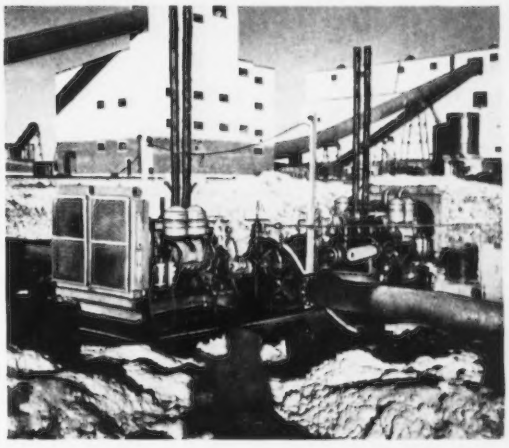
BAY CITY, MICHIGAN

GM DIESEL
CASE HISTORY No. 524-1

USER: Barvue Mines, Ltd., Barraute, Quebec. Hydraulic Superintendent, Bert Thomas.

INSTALLATION: Six GM Series 71 Diesel Twins; two drive 2-stage centrifugal pump supplying three 2-inch monitors which jet the water at 125 psi; two on 12-inch pump pumping water from La Flamme River, and two on 12-inch removal pump which sends slurry (25 to 35% solids) to tailing pit.

PERFORMANCE: Company is hydraulic-stripping about 1,000,000 yards of clay overburden for about 35¢ a yard. Barvue Mines estimated $1.25 a yard to strip by ordinary methods.



SAVED:

$.90 PER YARD ON ONE-MILLION-YARD STRIPPING JOB

Here's a unique application that *proves the profit* of General Motors Diesel power.

Superintendent Thomas reports that the six GM Diesel Twins powering the pumps in this hydraulic stripping operation are on the job 24 hours a day, 7 days a week, except for a 2-hour stop on Saturdays to change oil and filters.

Because of their 2-cycle operation (power at *every* piston downstroke) GM Diesels deliver the steady, uniform power required to keep a steady pressure at the monitors. They burn a minimum of low-cost Diesel fuel. Compactness and light weight make them easy to move. And in remote locations like this, standardization of design means a lot, because a small stock of low-cost parts protects all twelve engines. For dependable Diesel power *at the lowest cost per horsepower hour*, see your GM Diesel distributor today.

DETROIT DIESEL ENGINE DIVISION
GENERAL MOTORS, DETROIT 28, MICHIGAN
Single Engines 16 to 275 H.P. Multiple Units Up to 840 H.P.

It pays to STANDARDIZE on

GM
GENERAL MOTORS
DIESEL POWER

The Winch Hoist that SAVES MONEY IN MINING

DOES THESE JOBS FASTER ...EASIER TOO!

★ MOVING AND HOISTING TIMBERS
★ HANDLING FANS AND DUCTS
★ MOVING, INSTALLING ELECTRIC SLUSHERS
★ SERVICING LARGE VALVES, MOTORS, ETC.
★ DOZENS OF OTHER MINE MAINTENANCE JOBS

The Lug-All weighs only 8¾ pounds! It lifts, lowers or pulls 1½ tons for 5 feet. Lifts, lowers or pulls ¾ ton 10 feet.

THE LUG-ALL IS VERSATILE—

Can be used single or double. It permits working around corners and within 10 inches headroom. Its removable handle can be reversed for greater convenience in tight quarters. The Lug-All works in *any* position.

THE LUG-ALL IS WELL CONSTRUCTED

Has preformed, corrosion resistant 133 strand aircraft cable for maximum strength and greatest flexibility.

Has only two springs—both *stainless steel*.

Cable housed on 2 inch drum—no rope or chain to dangle.

Oiled-for-life bearings — no servicing required.

Open construction—self-cleaning in mud, sand, dust or ice.

Double interlocking pawls always lock *automatically*, thus eliminate danger of slipping brakes.

"Safety-Valve" handle bends before any part of hoist is overloaded. Handle yields at approximately 100% above rated capacity.

GUARANTEED FOR ONE YEAR

Order your first Lug-All today. Or, write for free Bulletin #116, containing many helpful hoisting hints.

$35.25 FOB Factory

THE LUG-ALL COMPANY

WYNNEWOOD, 11, PENNA.

Cyprus *(Continued)*

duction rate: 500 tons per day by late 1953. Ore will be mined by open-pit methods. Plant will recover pyrite, and will produce 70% copper concentrates, plus gold and silver bullion for normal cyanidation.

GREECE

Negotiations for the supply of modern equipment for the Larymni mines are underway in Athens between Mr. Bodossakis Athanassiadis, of the Greek Chemical Fertilizer Co., owners of the mine, and Mr. Krupp von Bohlen, German industrialist. Mr. Krupp has shown particular interest in the nickel extracted from the Larymni mine.

GREENLAND

Northern Mining Co. (Nordisk Mineselskab A/S). Project: Lead-zinc mine at Blyklippen, King Oscar's Fjord, Mester Vig. Cost: $2.1-million. Grade of ore: Tunnel and surface drilling on upper level indicate length of 900 ft., grade approximately 20% combined lead and zinc over 30-ft. width. Starting date: July 1952. Reserves: Preliminary investigations indicate more than 400,000 tons of ore.

AUSTRIA

Aluminum production capacity for Austria's aluminum plants is as follows: Salzburger Aluminum Gesellschaft, Lend Salzburg, 9,000 tons per year. Vereinigte Aluminum-Werke Aktiengesellschaft, Upper Austria, 50,000 tons per year.

Bleiberger Bergwerks Union is now producing ores running 4 to 5% lead, and 3 to 4% zinc. Annual production rate of the mines is about 5,000 tons of lead contained in ores, and 5,000 tons of zinc contained in ores. Total capacity is about double that amount. Ores are smelted at Gailitz, Carinthia, Austria. A new electrolytic zinc plant is under construction and scheduled for completion in 1954.

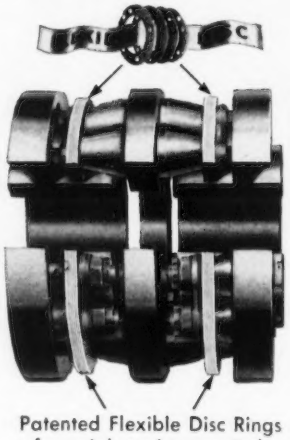
Mitterberger Kupferbau, Austria's nationalized copper unit has just completed a project doubling ore and copper production. Production for 1952 was 132,000 tons of ore containing about 2% copper, equivalent to 9,240 tons of concentrates running 28.5% copper, and 1953 production will be about 170,000 tons equivalent to a production of 18,800 tons of concentrates.

Austrian bauxite production rose in 1952 to over 15,000 tons from 8,000 tons in 1951. A further increase in output is expected in 1953.

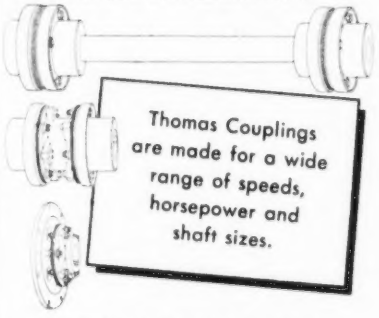
(Continued on page 264)

Specify THOMAS ALL METAL FLEXIBLE COUPLINGS for Power Transmission to avoid Costly Shut-Downs

DISTINCTIVE ADVANTAGES	
FACTS	EXPLANATION
NO MAINTENANCE	Requires No Attention. Visual Inspection While Operating.
NO LUBRICATION	No Wearing Parts. Freedom from Shut-downs.
NO BACKLASH	No Loose Parts. All Parts Solidly Bolted.
CAN NOT "CREATE" THRUST	Free End Float under Load and Misalignment. No Rubbing Action to cause Axial Movement.
PERMANENT TORSIONAL CHARACTERISTICS	Drives Like a Solid Coupling. Elastic Constant Does Not Change. Original Balance is Maintained.



Patented Flexible Disc Rings of special steel transmit the power and provide for parallel and angular misalignment as well as free end float.



Thomas Couplings are made for a wide range of speeds, horsepower and shaft sizes.

THE THOMAS PRINCIPLE GUARANTEES PERFECT BALANCE UNDER ALL CONDITIONS OF MISALIGNMENT

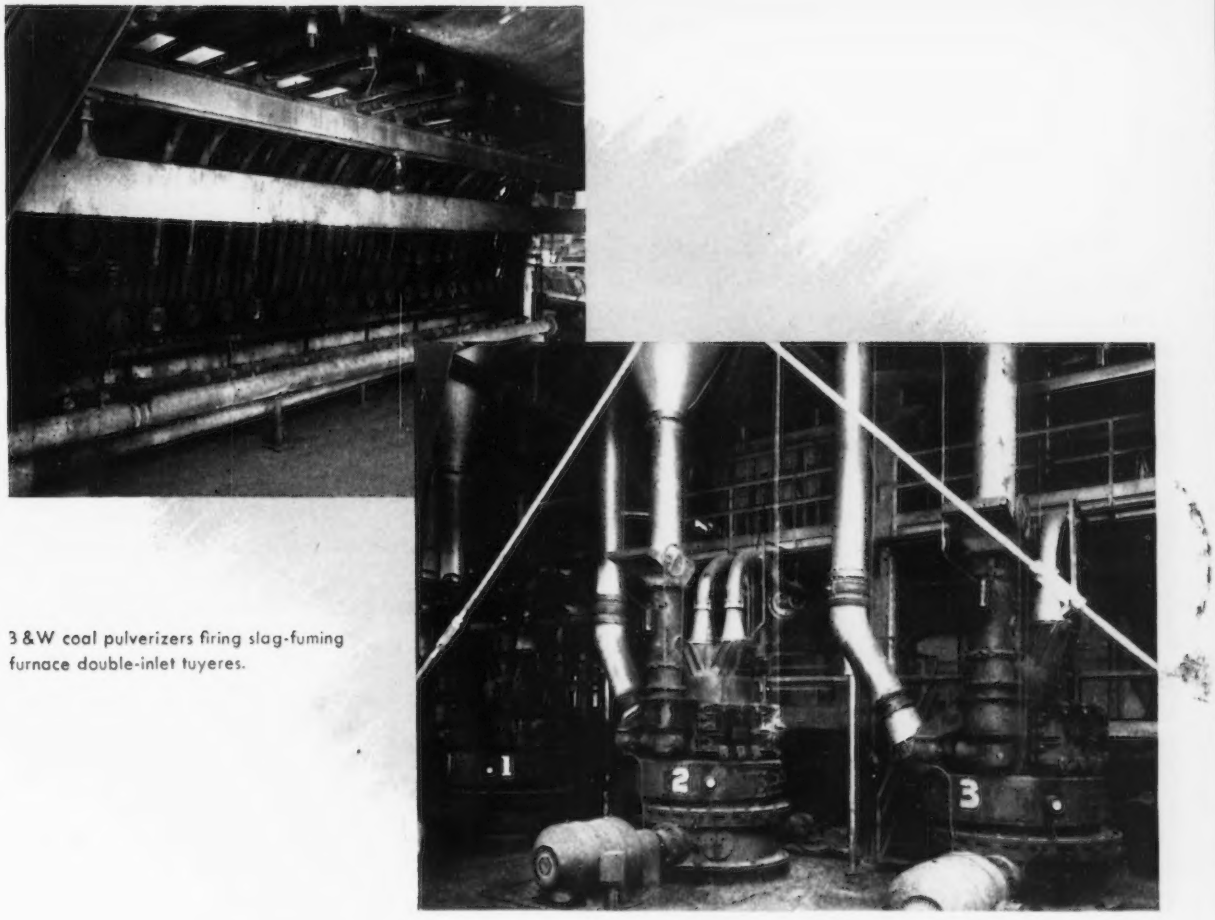
NO MAINTENANCE PROBLEMS

ALL PARTS ARE SOLIDLY BOLTED TOGETHER

Write for our new Engineering Catalog No. 51

THOMAS FLEXIBLE COUPLING CO.

WARREN, PENNSYLVANIA, U.S.A.



B & W coal pulverizers firing slag-fuming furnace double-inlet tuyeres.

B&W Pulverized-Coal Systems and Heat-Recovery Equipment

CUTTING COSTS IN METALLURGICAL PLANTS

—*from Canada to Mexico*

Most widely recognized as a manufacturer of a broad range of steam boilers and related fuel-burning equipment, B&W also has established recognition in the field of metallurgical process equipment . . . has engineered and installed cost-saving equipment in Canada, the United States, and Mexico.

Complete B&W coal-preparation and burning systems and heat-recovery equipment have been in service many years in the production of strategic metals, particularly in the recovery of zinc and lead from blast-furnace and reverberatory slags. The B&W systems are available complete (with the exception of the metallurgical furnaces) from raw-coal bins to heat-exchanger gas outlet, and with fully automatic control . . . as a complete "package." The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

BABCOCK & WILCOX

BOILER DIVISION

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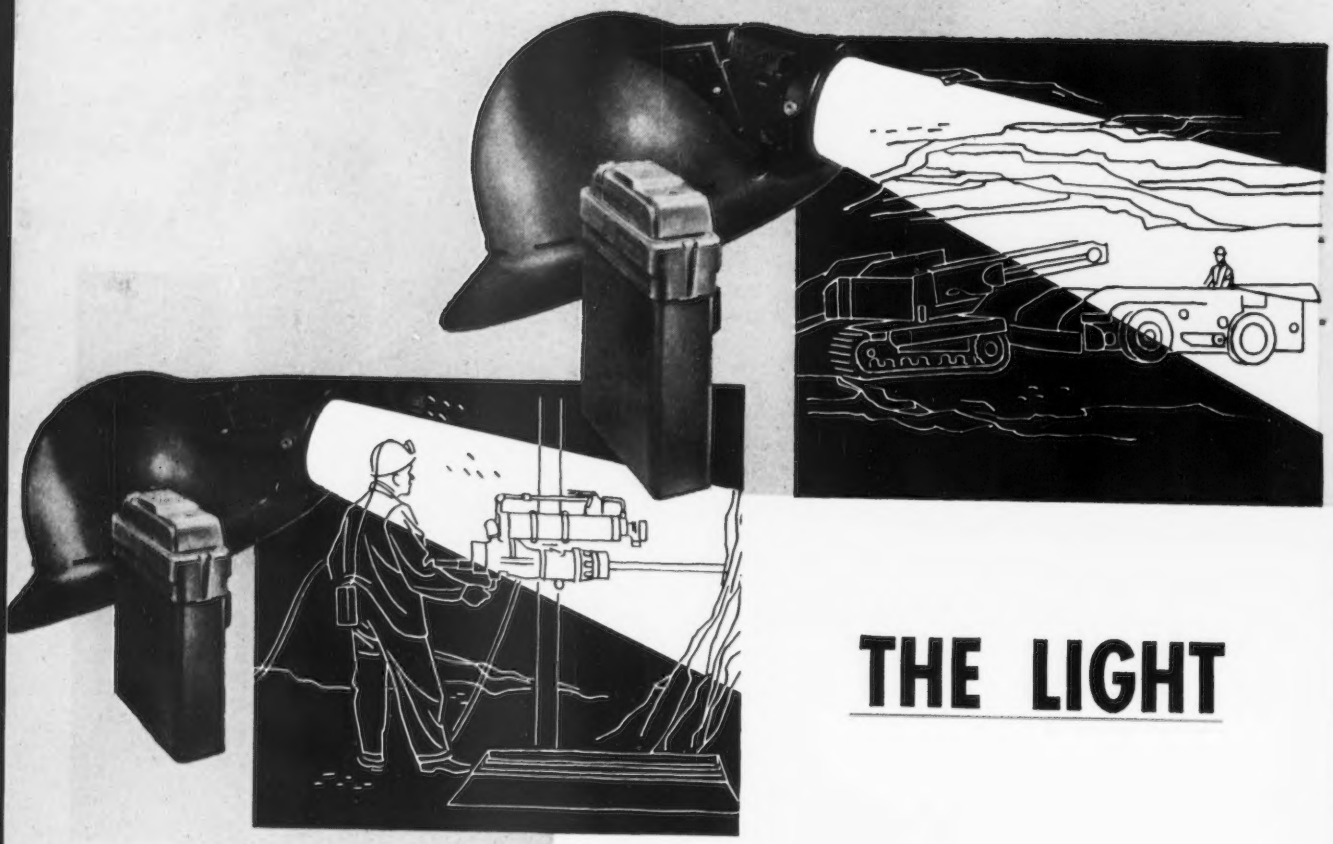
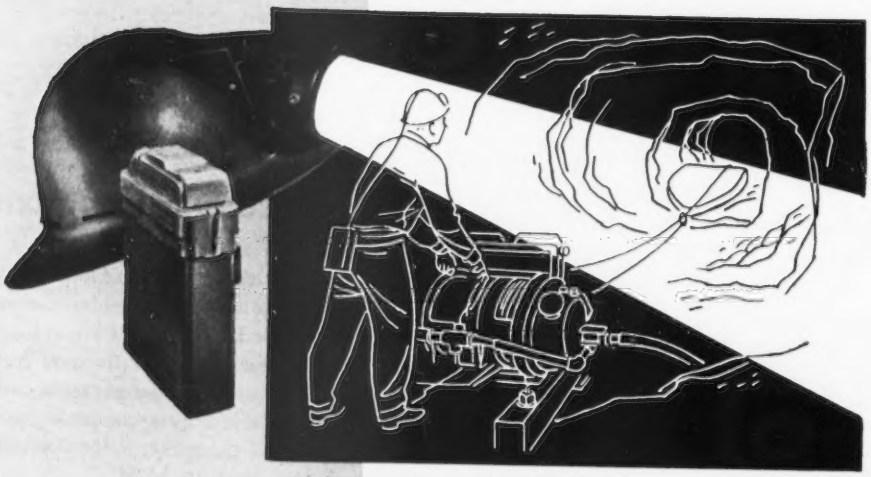
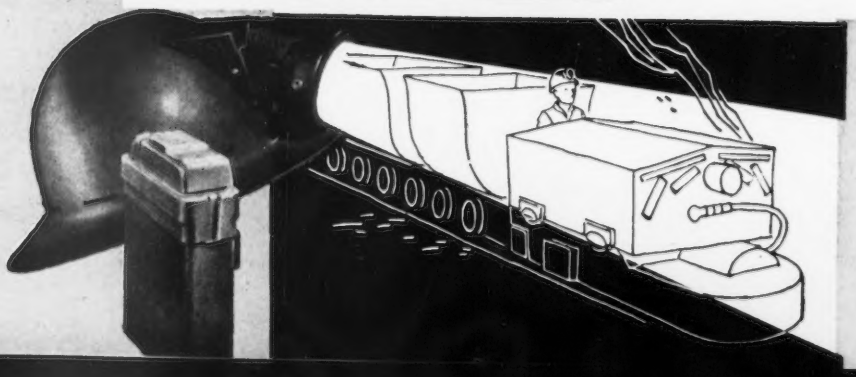
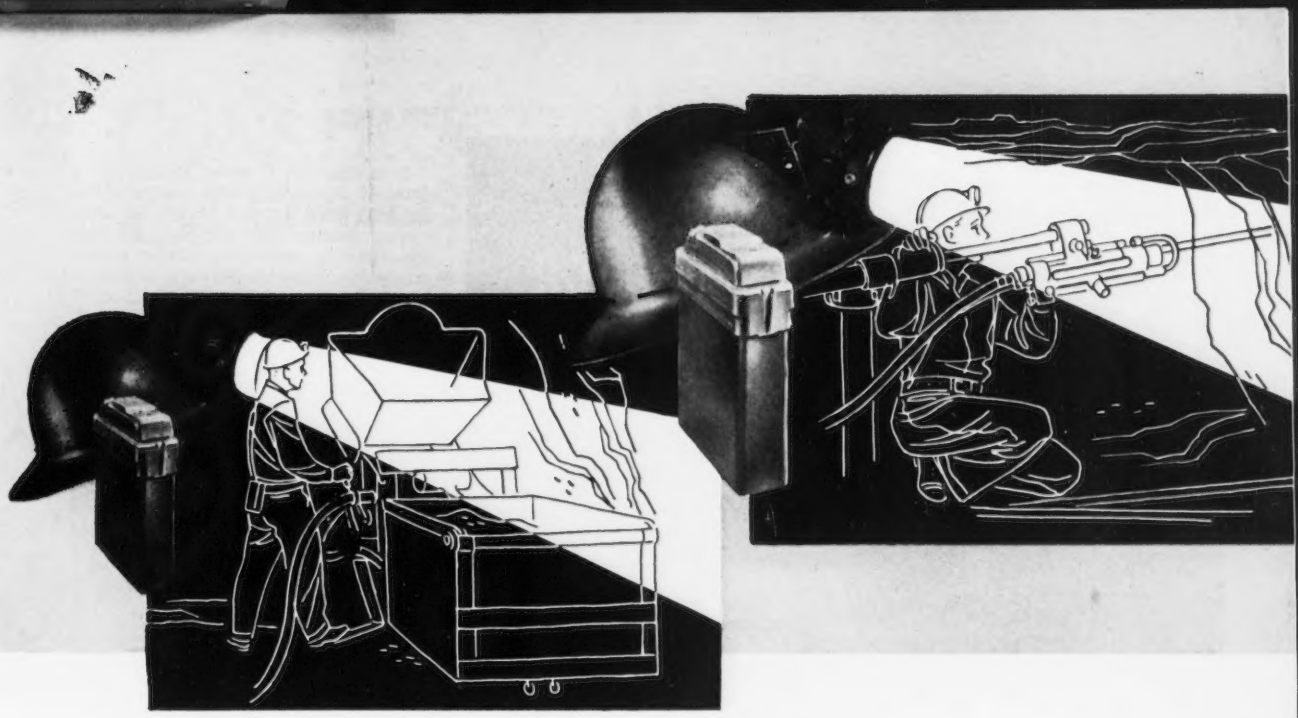


THE LIGHT







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the brilliant, unfailing EDISON R-4 ELECTRIC CAP LAMP

Because more and better light *is always on the job,* the Edison R-4 lets men and machines produce at their top level of output. This *illumination advantage* is helping miners everywhere utilize, with greater safety, the *production advantages* that are built into modern mining machines.

Let us show you how this vital mining tool can help *you* fill the gap between average and peak production.

MINE SAFETY APPLIANCES COMPANY
Braddock, Thomas and Meade Sts., Pittsburgh 8, Pa.
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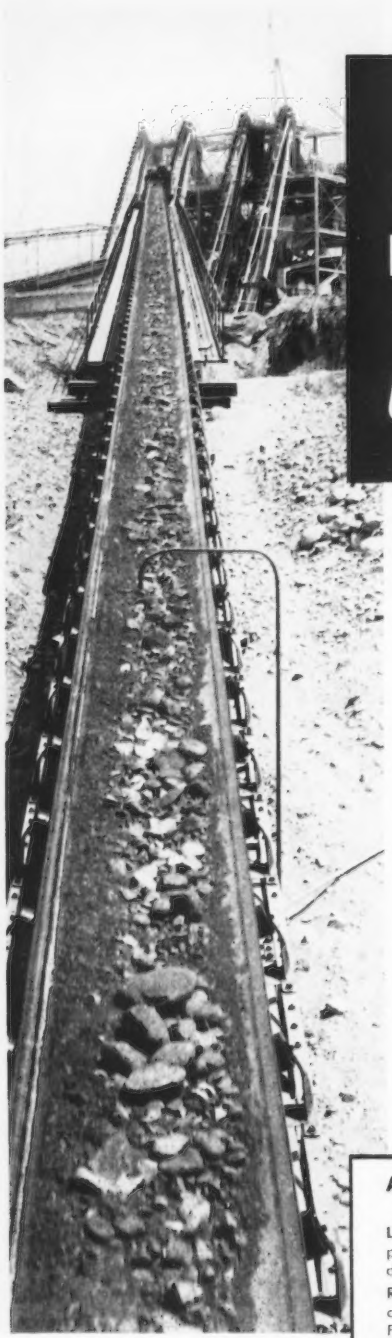
MSA
SAFETY EQUIPMENT HEADQUARTERS

When you have a safety problem, M.S.A. is at your service . . .
Our job is to help you.



1,056-ft. AMERICAN 6-ply, 36 oz. belt, 36" wide, at Southern California aggregate plant.

GOT CONVEYOR OR ELEVATOR BELT PROBLEMS? *Call American*

We're specifically set up to handle each belt application on an individual basis. Your AMERICAN belt is "tailored" to your conveyor set-up, the materials you handle, and to your operating conditions . . . *at no extra cost.*

The result is a belt perfectly matched to your needs, assuring *extra performance and added service life.* You'll be dollars and tons ahead to call AMERICAN *now.*

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CONVEYOR ENGINEERING DATA . . .

AMERICAN's complete catalog includes five pages of helpful, factual data on belt capacities, materials characteristics, h.p. requirements, tension ratios, belt weights, etc. Write for *your* copy TODAY.

AMERICAN "SPECIALS"
Lick Special Jobs . . .

LIGHTNING RIBBED CENTER BELT grips slippery, loose material; increases tonnage, reduces abrasion.

RAISED CENTER BELT puts extra rubber in center to take wear, cushion loading shock. Flexible sides trough easier.

PULLEY LAGGING (block, friction, or crowned) eliminates excessive take-up tension, usually permits use of fewer plies.

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FRANCE

Iron Mines in France. Since 1947 a total of about 25-billion francs ($71-million) has been invested in iron mines within metropolitan France. Investments have been almost exclusively for modernization and re-equipment of existing mines. Production of iron ore has risen from 35-million metric tons in 1933 to 40-million tons in 1952. Modern equipment has improved output. Before the war only 5% of the ore in the Lorraine was transported mechanically. Today 70% is moved mechanically. The following list includes production in metric tons of larger mines where modernization has taken place:

Name of Mine	Jan. '47 Production	Jan. '53 Production
Amermont-Dommary	50,917	123,000
Bazailles	33,480	113,212
Giraumont	39,757	111,982
Snacy	45,300	100,100
Homecourt	51,851	117,298
Joeuf	42,687	96,630
Charles Ferdinand	47,423	105,477
Orne et Pauline	56,676	131,942
Montrouge	102,983	126,251
Hayange	38,513	101,713
Droitaumont	31,148	89,314
Angevilliers	30,390	93,488

YUGOSLAVIA

Strnisce, Slovenia. Project: New alumina and aluminum plant under construction. Publicly owned. Capacity: 100,000 tons alumina, 30,000 tons aluminum, per year. Starting date: Late 1953. Pot capacity: Each, 300 kg. of aluminum per day. About two tons of aluminum oxide used to produce one ton of aluminum. Alumina will be produced by Tower system (British). Aluminum will be produced by Soderberg process (Norwegian).

Sisak, Croatia. Project: New seamless steel tube plant nearing completion. Publicly owned. Capacity: 60,000 tons of seamless tubes in three different sizes. Schedule: Production of small tubes began in 1953. Output estimated at 7,500. Medium-tube production due to start late in 1953. Large-tube production due to start in 1954. Technical facts: Small tubes up to 98 mm. outside diameter; medium tubes—98 to 193 mm. outside diameter; large tubes—193 to 345 mm. outside diameter, with potential of 400 mm. outside diameter. Machinery supplied by Innocenti (Italian) and being erected by Italian engineers. Electrical installations by Ansaldo (Italian).

Sabac, Serbia. Project: New electrolytic zinc plant under construction. Publicly owned. Also produces super-phosphates and cadmium. Investment: Partly financed by loan from International Bank for Reconstruction and Development. Capacity: 12,000 tons electrolytic zinc, 60,000 tons super-phosphates, 35 tons cadmium, per year. Schedule: Production of zinc to start in 1955.

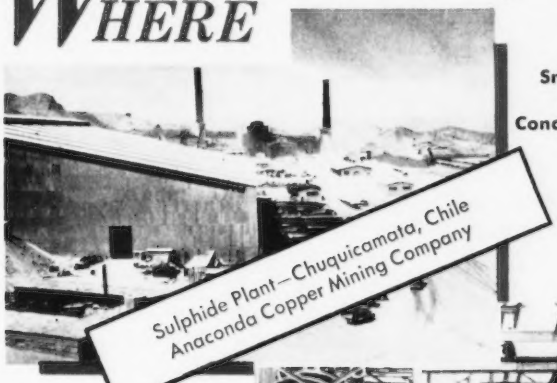
(Continued on page 266)

CONSTRUCTION FOR MINING

A COMPLETELY INTEGRATED SERVICE

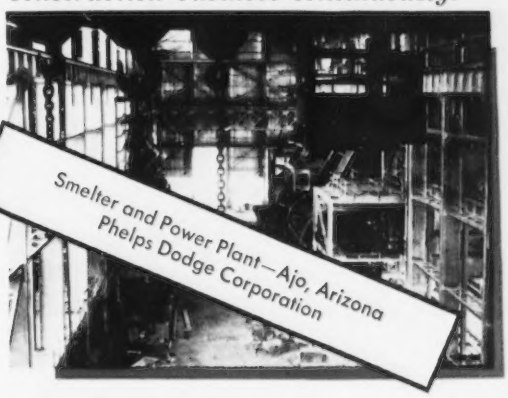
by men who have done it

WHEN WHERE *Since 1874, Foley Brothers, Inc. has been in the construction business continuously.*



Sulphide Plant—Chuquicamata, Chile
Anaconda Copper Mining Company

Smelters and Concentrators



Smelter and Power Plant—Ajo, Arizona
Phelps Dodge Corporation

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Roads
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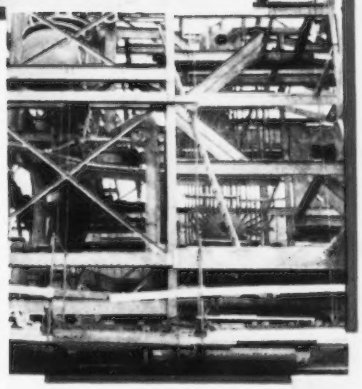

Boiler Plants— ▲
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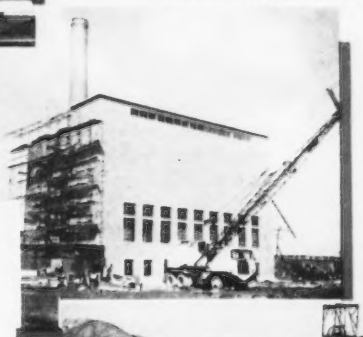
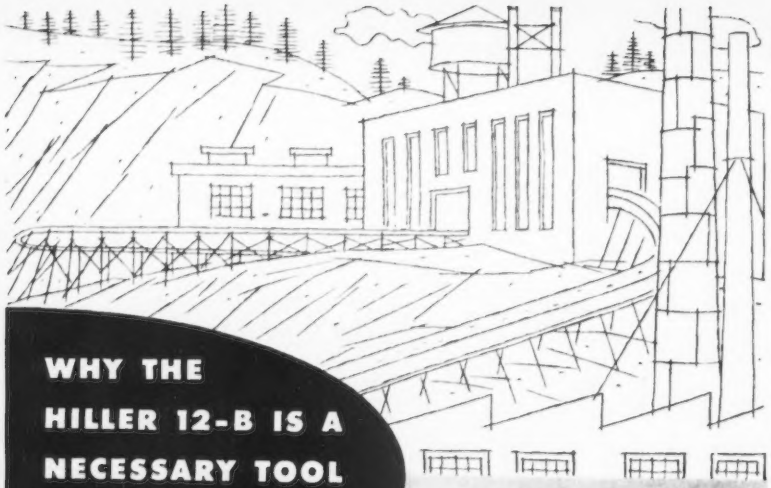
Buffalo, New York ▶
American Brass Company



Dams
Tunnels & Shafts
Dry Docks
Piers
Industrial Developments
Aircraft Plants

Ore Loading Facilities—Coquimbo, Chile
Bethlehem Chile Iron Mines Co.

Ruth Shaft—Ely, Nevada
Kennecott Copper Corporation



WHY THE HILLER 12-B IS A NECESSARY TOOL OF THE MINING INDUSTRY

Tough competition today requires that you take advantage of industry's most modern production tools to increase operational efficiency. Such a tool is the Hiller 12-B... a helicopter which can do many jobs for you *better, faster, more economically!*
A few uses already proved are:

Geological Surveys	Personal Transportation
Material Transportation	Construction Work
Exploration	Search and Rescue

Because a helicopter can fly at very low speeds... can land and take off almost anywhere... can stop and stand still in the air... and can cruise at the speed of an average light plane, it can perform industrial functions that will greatly increase the efficiency of your operations. And because of its ruggedly built, all-metal construction, its exceptional stability, ease of control, and its 3-passenger comfort in flight, the *Hiller 12-B* is the best in the field.
Exclusive design features, proved in more than four years of successful operation throughout the world, make the Hiller 12-B the leader in its field for utility, safety, and performance.

Write or wire us today for an analysis of how you can profit by using the Hiller 12-B in your business.

HILLER HELICOPTERS 1350 Willow Road Palo Alto, California

Hiller builds a better helicopter

ITALY

Ferromin. Project: Iron mine and concentrator at San Leone, Sardinia. Investment: $3-million. Product: Iron ore. Grade of ore: 35% iron. Capacity of expanded plant: 180,000 tons per year of 65% iron ore concentrate. Starting date: Late 1954.

Project will involve new iron ore mines and two electro-magnetic concentrators, one for the production of 51-52% dry iron concentrates, and one for production of 65-68% wet concentrates.

Sapez. Project: New lead-zinc flotation plant at Agruxau Mount Mine, Sardinia. Investment: $130,000. Product: Lead and zinc from oxidized ore. Grade of ore: 8% lead, 20% zinc. Capacity of expanded plant: 200-250 tons of ore per day. Starting date: Late 1953.

Calamine ore will be treated by a new flotation process to double present zinc concentrate production.

AMMI. Project: Scheelite flotation plant at Villa Salto, Cagliari. Investment: $80,000. Product: Scheelite. Grade of ore: 2-4% WO_3. Capacity of plant: 1,000-1,500 kg. of scheelite concentrates assaying 78% WO_3. Starting date: Early 1954.

Cornigliano S.P.A. Project: Integrated steel plant at Genoa, Cornigliano. Investment: $80-million. Starting date: Late 1954.

New integrated steel plant will treat 50% iron ore concentrates to produce 500,000 tons of cast iron per year.

SPAIN

Minas de Almagrera (MASA). Project: Silver-lead mine at Sierra de Almagrera (Almeria). Investment: 141-million pesetas.

Plans call for investigation and drainage of this classic mine on "Coto" Peak of the Sierra de Almagrera (Almeria). The mine will be worked with diesel-powered motors, although the original plan was to use electricity. At one time drilling had to be suspended at the 285-m. level because of water. A 4,123-m. double-track tunnel is being driven into the mine at the axis of the mountain to be used for the extraction of metal. Production of this mine was stopped at the turn of the century when a lead shaft caved in and the mine became flooded. Private capital could not put it back into operation again, so State funds from the **Institute Nacional de Industria** were secured.

Rio Tinto Co. Ltd. Minas. Project: Copper, pyrites mine at Huelva Province. Investment: £3,750,000.

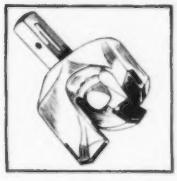
Plans call for production to increase to 700,000 tons pyrites per year by replacing old machinery through $1-million Export-Import Bank loan and funds from the Spanish Government. This will enable the company to

Rotary Bit Drills 4500′ In Potash Ore

Satisfactory results are reported in the rotary drilling of hard potash ore in southeastern New Mexico, as 4500 feet of drilling is being obtained in langbenite per average bit life. Jeffrey A-6 Drills equipped with Kennametal Tungsten Carbide Insert Rotary Bits, 1½" in diameter, are used.

•

Iron Ore Rotary Drilled



In one operation in Minnesota, an unusual use of Kennametal Tungsten Carbide Rotary Drill Bits is being made to drill in the overburden in recovering low grade ore. The boring is done horizontally. Speed and mobility over the churn drilling method are the advantages reported.

•

108′ Holes In Gypsum Drilled By Rotary Bit

A large gypsum mine operator in Virginia reports that holes are now being drilled successfully to a depth of 108 feet by the use of rotary auger-type equipment, supplementing core drilling equipment for long hole drilling. Advantages are: Speed, freedom from water and dust, easy mobility. Kennametal 17/8" Tungsten Carbide Bits and scroll-type auger are used.

•

Structural Bit Gives Big Ore Samples

A six-point "Chopping Bit" used on the Mesabi Range to determine quality of formation is reported to cut cost 50% to 70% in two instances where it has been used. A big feature is that it produces large, easy-to-analyze chunks of ore. It is set with 6 Kennametal Tungsten Carbide Inserts.

KENNAMETAL Rock Bits

Style PT Rock Bits are used to drill fissured, ravelly, non-uniform ground. Faster drilling, (by about 10%) in these conditions is assured by the three-point design.

Style PA Rock Bits give superior service and faster, lower cost drilling in hard, uniform ground. Both PA and PT bits have ample clearance for cuttings.

After more years of experience than any other American manufacturer in the development of tungsten carbide rock bits, Kennametal has produced these modern bit designs that assure efficient drilling in all types of ground.

"Three-point" construction is offered in the Kennametal multiple-point bit to give additional drilling speed (10% or more in many cases) where the use of multiple-point bits are necessary. Where conditions permit, such as in solid hard drilling, the chisel-type bit gives high rates of penetration.

Kennametal Bits offer long life because they feature inserts of Kennametal tungsten carbide, the carbide used in more mining bits than any other carbide in the world.

Special construction features are: Good clearance for free removal of cuttings; easy reconditioning.

Detailed information on request by writing: Kennametal Inc., Bedford, Pa.

KENNAMETAL inserts make the BIG difference

Kennametal inserts make the BIG difference in every drilling job as they feature long wear and high resistance to shock. They are produced according to special Kennametal processes that differ from any others in the world. They are dependably more uniform in quality. Kennametal's Nevada Scheelite Mine produces much of the tungsten used in their manufacture.

KENNAMETAL®

BITS FOR ROTARY AND PNEUMATIC DRILLING IN METAL AND NON-METALLIC MINERAL MINES

ROCK BITS • DRAG BITS • CORE BITS • DRILL BITS FOR SPECIAL JOBS

Your Management wants to know...

How valuable dust recovery saves dollars

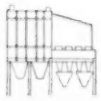
. . . .

In every industry, from ore to fabric to steel, Buell engineers, working with plant engineers, have established an enviable 18-year record of turning unnecessary dust losses into substantial new profits. What's more, a Buell Dust Recovery System uncovers these additional important advantages: improved product quality, smoother plant-community relations and higher employee morale.

To take advantage of Buell's background and experience in the highly specialized science of Dust Recovery, ask for further information about Buell's **3 basic systems** of dust collection. See how they can help you turn dust into dollars. Send for Buell's new, informative bulletin titled, "The Collection and Recovery of Industrial Dusts." Buell Engineering Company, Dept. 19-G, 70 Pine Street, New York 5, New York.

Van Tongeren Cyclone

'SF' Electric Precipitator



Precipitator-Cyclone Combination

Type 'LR' Collector

Dust Hopper Valves

ELECTRIC CYCLONIC ® buell

ENGINEERED EFFICIENCY IN DUST COLLECTION

Spain *(Continued)*

boost its pyrites exports. Present copper production of about 5,000 tons yearly probably cannot be increased.

Minas de Almaden y Arraynes. Project: Mercury mine and plant at Ciudad Real. This State enterprise, produced 1,785,000 kg. mercury for a total value of 53,514,350 pesetas in 1950. The plant is increasing production through purchase of additional equipment under the Export-Import Bank program.

Empresa Nacional de Alumino. Project: Aluminum plant at Valladolid. Investment: 115-million pesetas. Production: 2,500 tons of aluminum; 10,000 tons expected by 1954.

Techniques and equipment are similar to those of the consultant called in for the design of the plant—Alais, Goges et Camargue (Pechiney-Paris, France), project organized in 1943. Plan is to import raw materials until such are available in Spain.

Empresa Nacional de Alumino also has a unit at San Juan de Nieve, Playon de Raices (Aviles) in the north of Spain with a projected annual production of pure aluminum of 2,000 tons. This unit will also have a 10,000-ton yearly rate when operating full-scale. Enfeld Rolling Mills (Aluminum) Ltd. was the consultant. Coal and bauxite are being imported for it, but no opening date for this plant has been set yet.

IN AFRICA

Recovery of uranium as a "co-product" from the gold ores of South Africa's Rand has excited an unprecedented wave of interest in this area. The uranium will be recovered from residues obtained from the extraction of gold. At present, 16 major companies and three minor mines are to undertake this work. In due course, other properties will undertake this work. Capital expenditures involved in the development of this program are estimated to be in excess of $85-million, and when the plants are in full production earnings may amount to some $112-million per year. Mines undertaking this work are as follows:

East Rand: Vogelstruisbult and Daggafontein.

West Rand: Luipaards Vlei, West Rand Consolidated, and Randfontein.

Far West Rand: Blyvooriutzicht and West Driefontein.

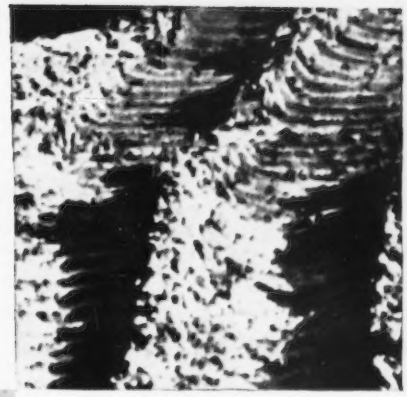
Klerksdorp Area: Western Reefs and Stilfontein.

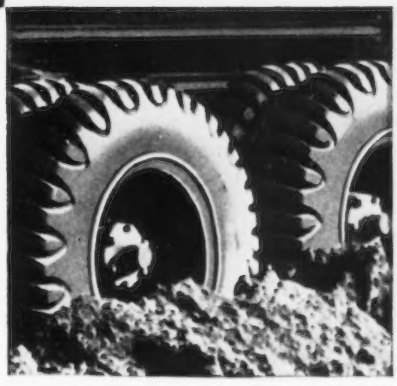
Orange Free State: Free State Geduld, Harmony G. M., President Brand, President Steyn, Virginia G. M., Welkom G. M.

There is a strong possibility that

(Continued on page 274)

THE TRACK OF A Mack TELLS A STORY OF Power





Ever notice the ground where a Mack six-wheeled truck has passed over? No scuff marks here. The track of a Mack tells a story of unfaltering traction . . . of surefooted, relentless driving power.

The "reason why" is found in Mack's Balanced Bogie with exclusive inter-axle and inter-wheel Power Dividers that assure positive traction under the most adverse conditions. Acting normally as a true differential, the Power Divider delivers torque between the bogie axles and wheels in proportion to wheel traction, thus eliminating useless wheel slippage and spinning.

Your nearest Mack branch or distributor will show you how Mack six-wheelers can keep your big loads moving fast—no matter how tough the terrain—on dependable, time-saving, cost-cutting schedules.

Mack TRUCKS

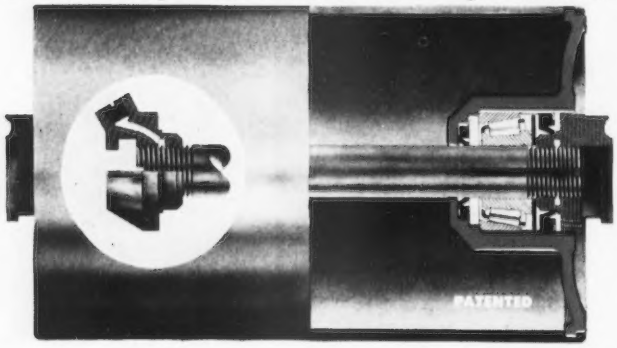
1726

. . . Outearn Them All

Mack Trucks, Empire State Building, New York 1, N. Y. Factory branches and distributors in all principal cities for service and parts. In Canada: Mack Trucks of Canada, Ltd.

You Need... CONTINENTAL'S NEW UST Idlers

CGC UNIT-SEALED CGC PRE-LUBRICATED CGC TIMKEN BEARINGS



Saves Grease!
Saves Labor!
Saves Belts!
Long Life- THE ULTIMATE IN MINIMUM MAINTENANCE

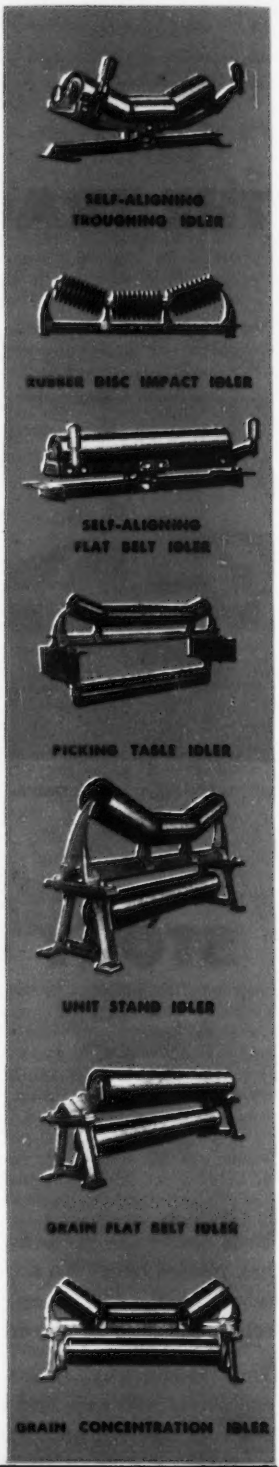
Continental's Unit-Sealed "UST" Conveyor Idlers, incorporating Timken Bearings, Garlock Klozures, are the answer to the operator's prayer.

The Unit Bearing Assemblies—"sealed unto themselves" provide an ample but not excessive grease reservoir. This represents a saving of grease and further eliminates any possible migration of the grease from upper to lower bearings on inclined rolls. The lubricant is a top quality water repellant grease of a stable consistency with a wide temperature range for long life.

Most important—this construction permits operating the Continental "UST" Idler for extended periods of time without relubrication for 1-2-3 years or longer depending upon the severity or character of conditions.

For detailed information on these idlers write for Bulletin EM-116

CG—5210



INDUSTRIAL DIVISION
CONTINENTAL GIN COMPANY
BIRMINGHAM, ALABAMA
ENGINEERS CGC ATLANTA • DALLAS • MEMPHIS • NEW YORK CGC MANUFACTURERS

HIGHER RECOVERY FROM LOW-GRADE ORES BY ION EXCHANGE

EXPANDING demand calls for the recovery of metals now *needlessly* going to waste . . . improved techniques for working lower grade, complex ores.

New Ion Exchange processes will play a big part in achieving these goals. For Ion Exchangers can pick up metals from dilute leaching or mine water solutions . . . return them as *10% concentrations*—at *low* cost. In fact, the more dilute the solution, the greater the savings over conventional processes.

METAL RECOVERY

Permutit Ion Exchangers are profitably at work recovering metals. A recent Permutit installation recovers copper from cuprammonium rayon wastes. Copper is present at only 25-40 ppm. Yet about a ton per day is recovered from waste water. Another plant is recovering zinc; several are recovering chromates.

Other applications range from purifying pickling solutions to the separation of rare earths in macro quantities.

Permutit is ideally equipped to work with your engineers in developing new Ion Exchange processes tailored to your needs. Only Permutit manufactures both Ion Exchange resins and equipment of all types—provides undivided responsibility for plant performance. Take advantage of our forty years of experience in Ion Exchange. Write today for full information on any Ion Exchange or water conditioning problem.

FREE TECHNICAL BULLETIN

Interesting, 16 page report on Ion Exchange suggests numerous new techniques for hydrometallurgy. It includes:

1. *Concentration*—Returns dilute solutions from mine waters or leaching as 10% solutions—at low cost.

2. *Separation* of mixtures of metals.

3. *Purification* of process or electrolyte solutions.

4. *Addition*—It is easy to convert salts to acids by Ion Exchange.

5. *Resin in Pulp*—Direct adsorption of metal ions by Ion Exchangers, followed by elution, promises considerable savings in investment, labor, pumping, loss to tailings.

MAIL COUPON TODAY!

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ION EXCHANGE AND WATER CONDITIONING HEADQUARTERS FOR OVER 40 YEARS

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THE DRIVE THAT

GUARDS AGAINST OVERLOADS

ELIMINATES...
Shear-Pins
...Electrical
Overload
Relays

Philadelphia
WORM GEAR REDUCERS
with "Torque Control"

Here is a worm gear drive which safely and surely protects against overload damage to conveyor assemblies and other industrial machinery yet operates without the use of shear pins or electrical overload relays. The *Torque Control* unit may be set for almost any predetermined torque—when this loading is exceeded the driving motor is instantaneously stopped, thus protecting the entire train of equipment.

To restart, only removal of the cause of overload is required. No resetting or replacement of parts is necessary.

The *Torque Control* unit was initially developed for the conveyor industry—its highly successful use in this field has led to its application on a wide range of industrial machinery where instant protection against overload or jamming is necessary.

Torque Control may be incorporated on any of the standard line of Philadelphia Worm Gear Speed Reducers in horsepower ratings up to 260 HP and ratios to 6300:1.

Torque Control is another example of advanced power transmission engineering by Philadelphia. Write us for full details.

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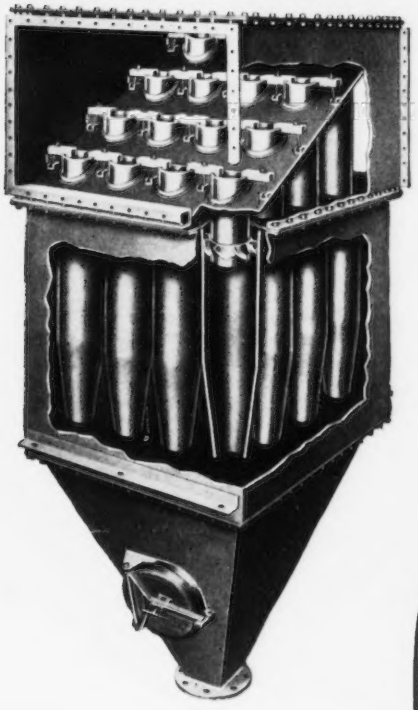


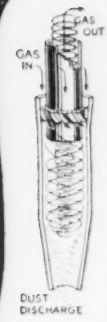
No wonder "MULTICLONE" is the leading name in the centrifugal recovery of dust from all types of gases, hot or cold.

No other mechanical recovery equipment has so many years of dust recovery experience behind it . . . or has such uniformly high collecting efficiency . . . or provides so many other money-saving, space-saving advantages as MULTICLONE. The four advantages outlined below are by no means the complete MULTICLONE story, but are typical of the vital savings found *exclusively* in MULTICLONE equipment . . .

In dust recovery

MULTICLONE COLLECTORS

***and only Multiclones* give vital advantages like these . . .**



Uniformly High Recovery:

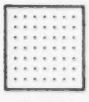
MULTICLONE's multiple *small diameter* tubes—made possible by its exclusive vane design—whirl the dirty gases with greater centrifugal force, thus throwing out not only the large, medium and small particles, but also a high percentage of the *extremely small* particles of 10 microns and less. This, coupled with the fact that there are no pads or filters to become choked with recovered material, results in a more complete recovery of *all* suspended materials from the gas stream.

Space-Saving Compactness:

Plant space costs money—so be sure to check space requirements carefully. As shown in the accompanying chart, the MULTICLONE requires less floor space and less cubic space than any other unit of comparable capacity and performance. Translate these savings into today's high costs for plant space and you readily see the great importance of this one MULTICLONE advantage alone!

Make	Relative Space Requirements In Sq. Ft.	In Cu. Ft.
Multiclone	1.0	1.0
Collector A	2.1	1.8
Collector B	5.9	3.2
Collector C	6.8	3.9

Long and narrow

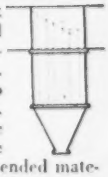


Square

Maximum Adaptability:

In addition to its unusual compactness, the MULTICLONE is also unusually adaptable to various installation requirements. Where head room is low it can be installed with side-inlet side-outlet connections. Where side clearances are restricted, it can be installed with side-inlet top-outlet connections. In addition, without changing capacities, the shape of the unit can be varied—long and narrow, short and wide, or square—to fit restricted spaces . . . and its single-inlet single-outlet duct requirements permit greater flexibility and simpler installation. These savings slice installation costs, space requirements and insulating expense.

Minimum Maintenance:



The MULTICLONE has no high speed moving parts to repair or replace . . . no pads or filters to clean or renew . . . nothing to choke the gas flow or increase draft losses as suspended materials are recovered. MULTICLONE draft losses remain uniformly low *at all times*. Further, the recovered material from an entire bank of tubes is collected in a *single* hopper—far easier to service and maintain than the multiple hoppers of conventional cyclone units.

FREE INFORMATIVE BOOKLET
This 32 page booklet outlines the basic principles of centrifugal dust recovery and shows the *many* ways MULTICLONE advantages assure higher recovery at lower overall costs. A free copy of this booklet will gladly be sent on request. Write today!

Before you decide on any recovery equipment be sure to get complete information on MULTICLONE advantages. A letter, wire or phone call to our nearest office places this information in your hands without obligation. Get all the facts and you will get MULTICLONE Collectors!

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SAFETY LESSON #1
A STEEL CHAIN REPAIRED WITH A MALLEABLE LINK BECOMES A MALLEABLE CHAIN.
A STEEL CHAIN REPAIRED WITH LAUGHLIN'S DROP FORGED STEEL "MISSING LINKS" BECOMES STRONGER THAN BEFORE

here's why COJ*

"MISSING LINKS"

REPAIR CHAINS BETTER

"MISSING LINKS"	ORDINARY LINKS
MATCHED	**UNMATCHED**
Made with special dies so that each half is pressure fitted. This eliminates play between the forgings, insures perfect fit when riveted into chain. There is no strain on the rivets.	When loose fitting links are put into a chain and the load is applied, the rivets take most of the strain and tend to shear until the links set. This may later cause the link to open up under heavy load.
INTERLOCKING LUGS	**ROUND LUGS**
More costly to put in the dies, but they grip firmer and really do the work of taking the load.	Ordinary round lugs fitting into round holes don't have the holding power, tend to shear or force out under strain.

Laughlin "Missing Links" are made of carefully heat treated, high grade steel. They have features found in no other repair links, and are also supplied in an exclusive pear shaped design in sizes for 3/8" to 1 1/8" chain.

Buy From Your Local Distributor

He is in business to give you prompt, courteous service and to save you money, time and trouble. He's your one best source for industrial supplies.

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THE THOMAS LAUGHLIN CO.
76 Fore St., Portland, Me.

* T. M. Reg.

South Africa *(Continued)*

all the Free State mines, at least 15 in due course, can be regarded as potential uranium producers. Finance for these projects is being provided through loans from the Atomic Energy Board on behalf of the United States and the British Governments. These are repayable from uranium profits over a period of 10 years. The price paid by the Atomic Energy Board is based on the cost of production plus a "reasonable margin of profit."

Other important developments in the Union of South African gold properties are as follows:

Jeanette G. M. Owing to a shortage of capital funds, shaft-sinking is on a limited scale, but the project is expected to follow the progress pattern of other Orange Free State mines.

Lorain G.M. Initial capacity 50,000 tons per month—will be increased to 100,000 tons.

F. S. Geduld. Initial capacity is 50,000 to 75,000 tons per month. This will be increased to 125,000 tons per month. Project delayed due to flooding of the No. 2 shaft last year.

President Brand. Initial capacity 50,000 to 75,000 tons per month. Will be increased to 125,000 tons per month. Starting date estimated to be 1954.

President Steyn. Initial capacity 50,000 to 75,000 tons per month. Will be increased to 12,500 tons per year. Production increase to start by late 1953.

Virginia G. M. Initial capacity 50,000 tons per month starting January 1954. Future capacity to be 125,000 tons per month by January 1956. Total expenditure for gold production alone estimated to be $31-million.

Merriespruit G. M. Initial capacity 50,000 tons per month starting January, 1956. Total capital expenditure for gold production alone estimated to be $22.5-million.

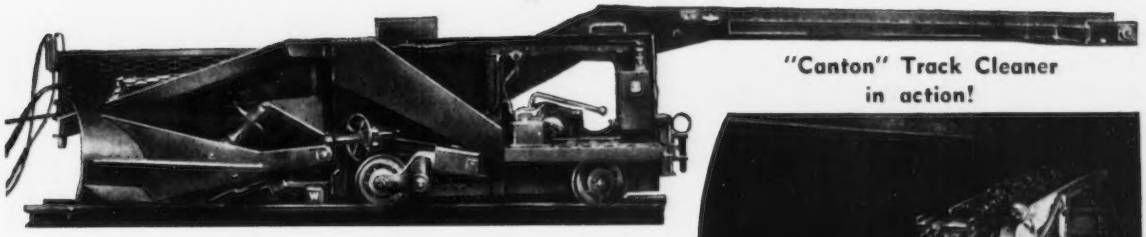
Harmony G. M. Initial milling capacity 45,000 tons, per month scheduled to begin in 1954. Borehole exploration indicates that this will be a high-grade property.

GOLD COAST

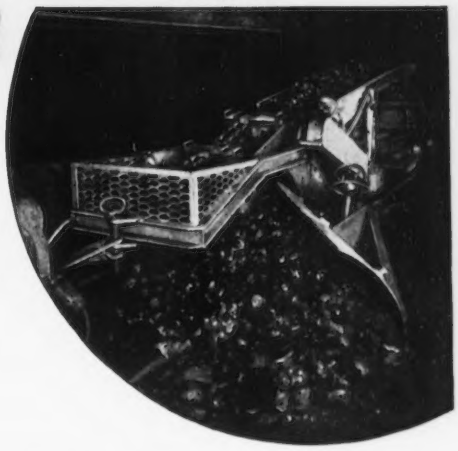
Expenditures totaling £144-million will be made to develop rich bauxite deposits at Mpreaso and Yenahin, and build an aluminum smelter at Kpong having ultimate capacity of 210,000 tons a year, a 564,000-kw. hydroelectric plant on the Volta River at Ajena, and extensive rail and port facilities. Tema will be the port. Aluminium Limited, of Canada and British Aluminium Co., Ltd. will manage mines and smelter. The power plant will be built and managed by British and Gold Coast governments.

First phase of the project will require five to seven years' development, costing £100-million at current

"American M.D.* products" for Savings

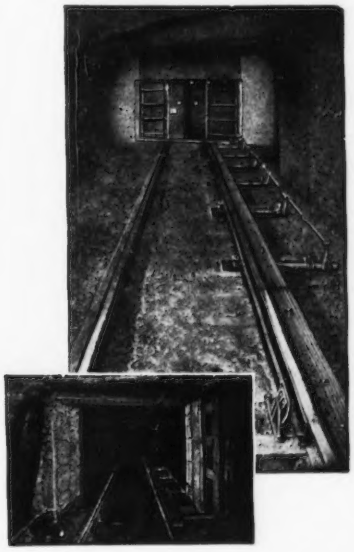


"Canton" Track Cleaner in action!



"Canton" Track Cleaner digs out gob—Recovers Coal.

Today, track cleaning is not a costly headache . . . it is a pleasant, profitable operation. No track workers to get hurt. Clean tracks once thoroughly with the Canton Track Cleaner. Then subsequent cleanings yield good coal. Load cars higher, haul more tonnage. Reclaim spillage mechanically. Write us for name of nearest mine where you can make inspection.



Write us what your track cleaning costs are and how many miles of track you clean, and we will show you how much extra profit you can make with a "Canton" Track Cleaner, after it has paid for itself.

The "American" Mine Door Speeds Up Trips for Profit.

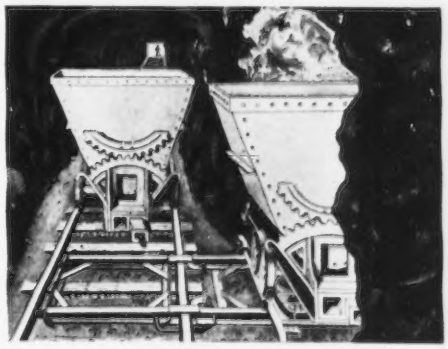
Insurance against accidents, increased haulage, continued speed ahead with "Canton" Automatic Doors make it imperative that every mine owner and manager investigate the economy proven by a quarter century of American Mine Door service.

Canton Doors are self-liquidating in a short period. Note the photos . . . when the oncoming train rides the trip levers . . . flip, the doors open; when the last car passes . . . release, the doors spring shut . . . positive action and reaction . . . all mechanical, in split seconds.

The "Canton" Car Transfer Loads entire Train, Single Track

The Canton Car Transfer saves time and money where tunnel space is costly. You are continually loading an empty while transferring the full car to rear. The Canton is easiest to use. Timken bearing equipped, sturdy, long-lasting construction. Canton Car Transfers are made for all track gauges . . . can be placed on track at any spot where side room permits, in two minutes by two men . . . built to hold cars up to six tons in weight.

Write for complete descriptive folders. In answering, please use street and zone numbers.



***American Mine Door Company**

2039 Dueber Avenue
Canton 6, Ohio

Manufacturers of "Dustributors"—Automatic Switch Throwers—Automatic Mine Doors—Mechanical Track Cleaners

Republic
WIRETEX AIR HOSE

Strength of Steel
PLUS+
Flexibility of Rubber

...and there's a NEW
ECONOMY LENGTH

WIRETEX, combining the strength of steel with the flexibility of rubber, brings you economical hose performance. Republic WIRETEX Air Hose easily handles air pressures up to 2,000 psi — and is ideally suited to work on less rigorous jobs, too, where extra service life and trouble-free performance is an asset.

Republic WIRETEX is NEW — a truly modern conductor internally reinforced with high tensile wire. It's easy to handle, unbelievably tough and long lasting. What's more, Republic WIRETEX is built in 60-foot **Economy Lengths.** You save money when you buy Republic WIRETEX; time and money when you use it! Get the facts today! Republic WIRETEX Hose is available in all standard (⅜" to 2" inclusive) sizes.

Your local Republic Distributor can help you plan, select, apply and maintain any Product of Industrial Rubber. If he is not listed in the yellow section of your telephone directory, write us for his name and address.

"Quality Hose Builders for More Than 50 Years"

REPUBLIC RUBBER DIVISION
LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN 1, OHIO
INDUSTRIAL RUBBER PRODUCTS

Gold Coast *(Continued)*

prices. This would provide plant capacity for 80,000 tons a year. The second phase would cost an additional £10-million, and increase capacity to 120,000 tons a year. Ultimate capacity would be attained in 20 years. Total reserves here are estimated at 200-million tons of bauxite. Ultimate investment in the smelter will be £64-million. The companies undertaking this project are anxious to stimulate a private capital market as a hedge against nationalization under a colonial government that is rapidly approaching dominion status.

RHODESIA

Mufulira Copper Mines Ltd. Project: Underground copper mine and mill at Chibuluma, Northern Rhodesia. Investment: $10.1-million. Reserves: 7.3-million tons 5.23% copper. Production rate: 19,000 tons copper per year. Capacity output: 1956. Recently it has been reported that original estimates of cost of bringing the Chibuluma property into production have been raised from £3.6-million to £6-million. To meet this situation, arrangements have been made with Defense Materials Procurement Agency of the U. S. A. which will increase the original unsecured loan by an amount not exceeding £2-million, provided that Mufulira increases its Chibuluma shareholding from £600,000 to £1-million. The additional £2-million like the first £3-million will be repayable in metals, and the U. S. government will have a prior option on 19% of Chibuluma's cobalt output, compared with 10% under the first arrangement. Chibuluma's management has more recently indicated that the start of copper production may be in the last half of 1955 instead of 1956 as planned earlier.

Mufulira Copper Mines Ltd. Project: Underground copper mine and mill at Baluba, Northern Rhodesia. Reserves: Under exploration. Production rate: 20,000 tons of copper per year (estimated). Capacity output: Indefinite.

Rhokana Corp., Ltd. Projects: Bancroft underground copper mine and mill and leach plant, Northern Rhodesia. Reserves: 80-million tons 3.6% copper. Production rates: 5,000 tons of ore per year and 48,000 tons of copper per year from mine; 6,000 tons of ore per year and 40,000 tons of copper per year from leach plant. Capacity output: 1957 for mine, 1956 for leach plant.

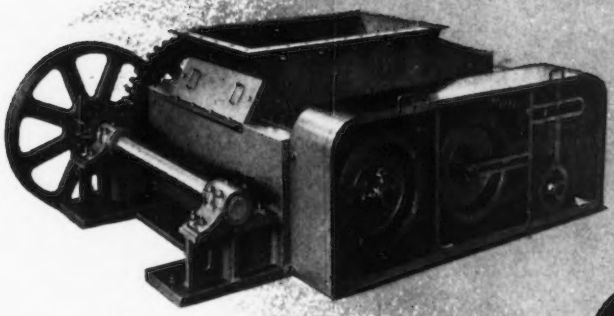
NIGERIA

Gold and Base Metal Mines of Nigeria. Project: Alluvial mine at Kano District, Northern Nigeria. Product:

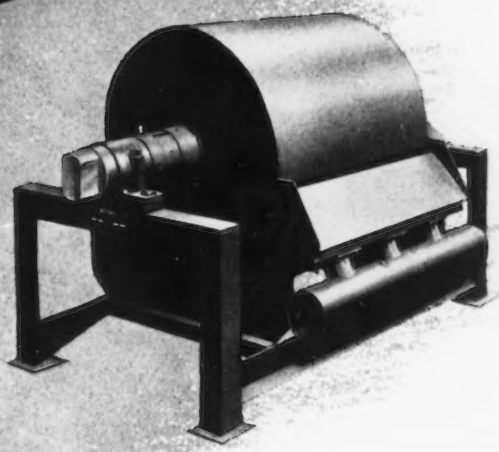
(Continued on page 278)

SPEED ORE PRODUCTION

with JEFFREY Crushers . . . Separators . . . Mechanical Vibrating Conveyors



Jeffrey Type SO Magnetic Separator for heavy media operations.



Jeffrey Double Roll 30" x 36" Crusher showing V-Belt drive between rolls.

Jeffrey single section open pan deck MV Conveyor, 18" wide x 15' long.

Other Jeffrey Products

FEEDERS	SCREENS
CRUSHERS	LOADING BOOMS
WASHERS	CONVEYORS
JIGS	ELEVATORS

PICKING TABLES
CHAINS & SPROCKETS
TRANSMISSION MACHINERY

WRITE FOR CATALOG 815-A

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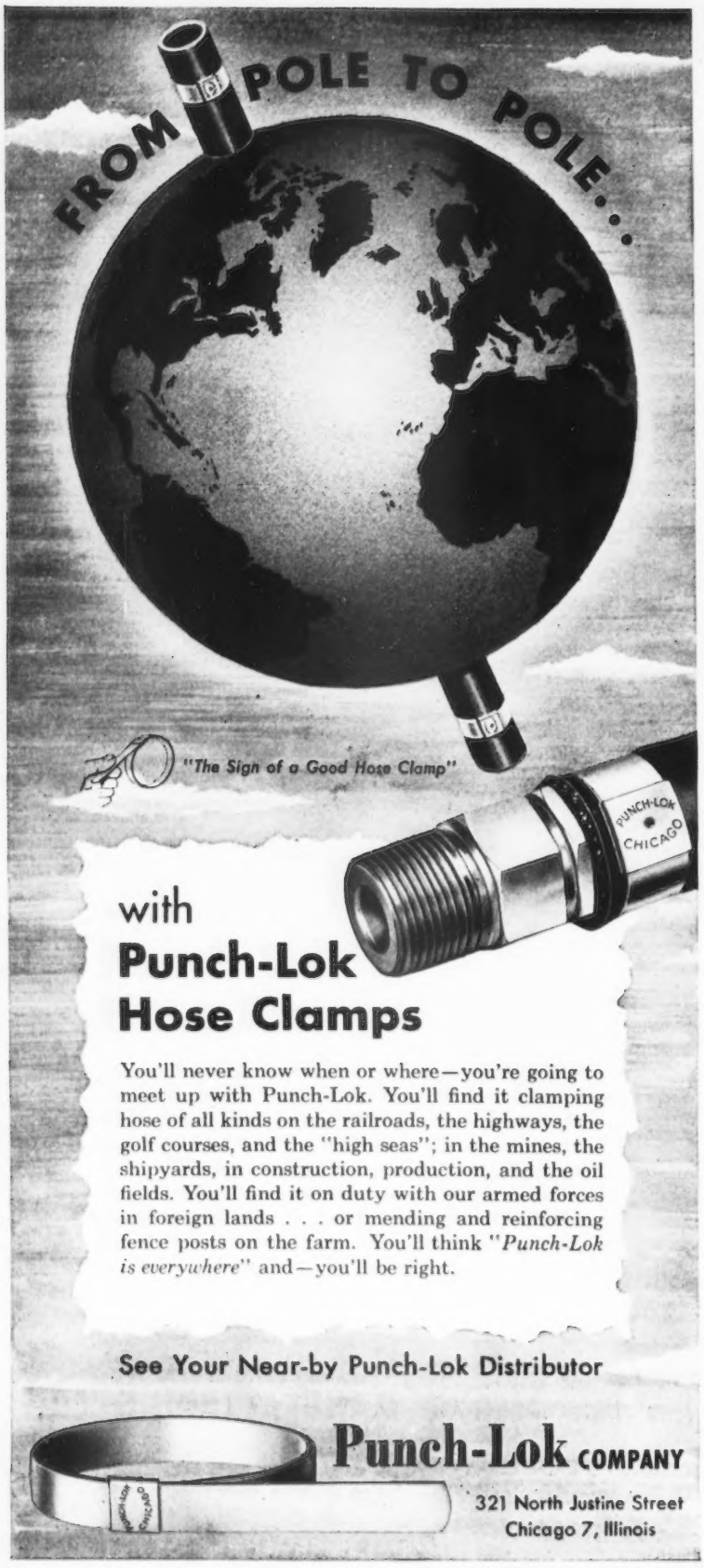
Columbus 16, Ohio

sales offices and distributors in principal cities

PLANTS IN CANADA, ENGLAND, SOUTH AFRICA

IF IT'S MINED, PROCESSED OR MOVED . . . *IT'S A JOB FOR JEFFREY!*


FROM POLE TO POLE...
"The Sign of a Good Hose Clamp"
PUNCH-LOK
CHICAGO
with
Punch-Lok
Hose Clamps
You'll never know when or where—you're going to meet up with Punch-Lok. You'll find it clamping hose of all kinds on the railroads, the highways, the golf courses, and the "high seas"; in the mines, the shipyards, in construction, production, and the oil fields. You'll find it on duty with our armed forces in foreign lands . . . or mending and reinforcing fence posts on the farm. You'll think "Punch-Lok is everywhere" and—you'll be right.
See Your Near-by Punch-Lok Distributor
Punch-Lok COMPANY
321 North Justine Street
Chicago 7, Illinois

Nigeria *(Continued)*

Columbite and tin. Investment: $700,000. Grade of ore: Undisclosed. Production rate: 1,500,000 lbs. tin and 176,000 lbs. columbite concentrates this year, rising to 1,700,000 lbs. tin and over 330,000 lbs. columbite in 1954. Special contract concluded with D.M.P.A. for the sale of columbite concentrates up to Dec. 31, 1953. All deposits will be exploited by monitors, gravel pumps and sluicing.

IN AUSTRALIA

Mt. Lyell Mining and Railway Co., Ltd. Project: Open-pit copper mine at West Lyell. Reserves: 40-million tons 0.70% copper. Production rate: 10,500 tons of copper per year. Capacity output: 1956.

Peko Gold Mine, Ltd. Project: Gold plant expansion and mine development work at Tennant Creek, Northern Territory. Products: Gold and copper. Expenditures: £300,000 (Austr.). Grade of ore: Copper reserves total 500,000 tons averaging 20% or more. Gold ore reserves total 19,000 tons averaging 16.5 dwt. per ton. Treatment plant will be expanded to handle 36,500 tons per year. The mine will be developed below the 300-ft. level, and diamond drilling will carry on beow the 400-ft. level. Concentrates will be treated in a Fluo-Solids roaster, and the calcine processed in a new chemical extraction plant.

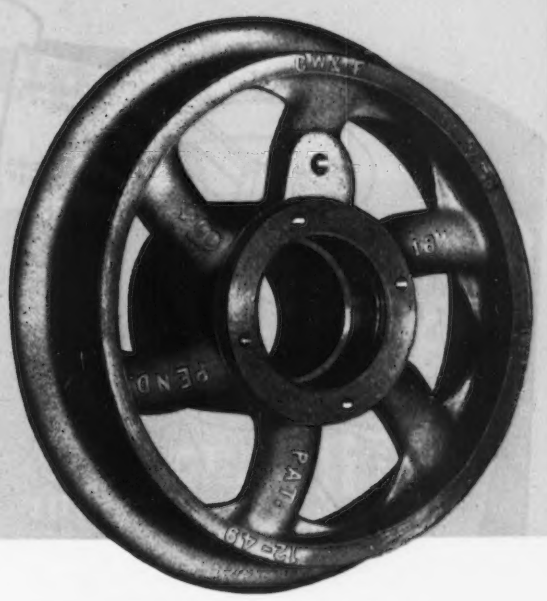
Home of Bullion Mine. Project: Plans call for a copper smelter and increased mine output at Barrow Creek, Northern Territory. Recent ore findings are extremely rich, and ore reserves have been increased considerably.

Victorian Antimony Mines, Ltd. Project: Consolidation of several gold-antimony mines in the Costerfield district of Victoria. Investment involved £132,000 (Austr.). Ore reserves: 13,000 tons containing 18% antimony, and 17 dwt. in gold per ton. The treatment plant is scheduled to treat 4,800 tons of ore per year. The plant is designed for the separation of antimony and gold, assisting recovery of copper from gold, and effecting recoveries of other base metals from complex ores. Start of operations: July, 1953. Expected profit: £265,000 (Austr.) per year. This same company has taken an option on the main antimony producing mine in the New England district of New South Wales.

Ravenshoe Tin Dredging, Ltd. Project: Installation of a tin dredge at Cairns, North Queensland. Capital: £400,000 (Austr.). This project was financed early in 1953 to work large alluvial deposits west of Cairn. A large dredge has been acquired in New Zealand, and will be dismantled and transported to Australia.

(Continued on page 282)

Positive protection against profit loss- when you use sterling CAST STEEL WHEELS



LESS WEAR ON CARS AND TRACKS

Sterling's exclusive balanced design cast *steel* wheels reduce vibration, prevent costly wear and tear on tracks and cars alike.

GREATER MILEAGE, LOWER OPERATING COSTS

Sterling cast *steel* wheels are precision engineered to give you far smoother transportation, greater mileage at less cost.

LOWER REPLACEMENT COST

Although Sterling cast *steel* wheels cost more than other types your *replacement* cost is actually *lowered* when you use the money-saving Sterling re-wheeling plan.

LESS DOWN TIME: REDUCED LABOR COST

Sterling cast *steel* wheels work-harden with each trip. This extreme hardness is uniform *throughout* tread and flange, assuring much longer life than other type wheels.

Transportation breakdowns can not only be expensive, but hazardous. A crushed wheel, derailed cars, a smashed locomotive can take the profit out of *any* mining operation. That's why STERLING STEEL CASTING COMPANY developed the exclusive balanced-design cast *steel* wheel, an engineering masterpiece that is your best assurance for dependable, low maintenance, trouble-free transportation. Aside from the great safety factor, in the long run Sterling cast *steel* wheels actually cost you *less* than any other type of wheel on the market today.

For complete information on the Sterling Plan, *a time-tested program for re-wheeling that will put you dollars ahead for years to come . . .*

mail this coupon today!

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STERLING STEEL CASTING COMPANY
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Please send complete information on the STERLING CAST-STEEL WHEEL REPLACEMENT PLAN to me immediately.

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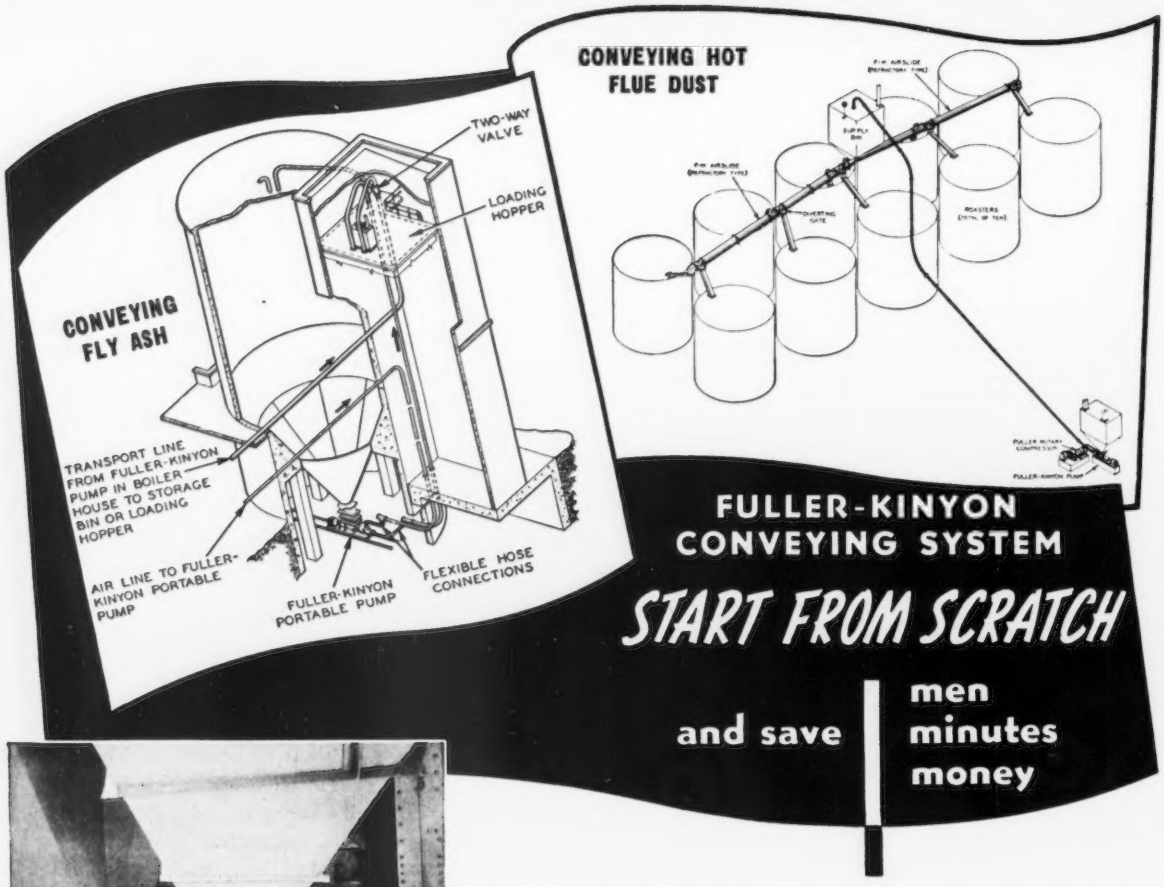
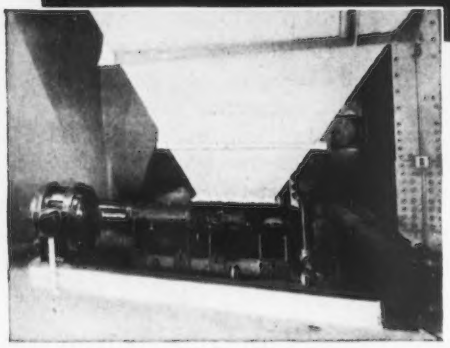
Company.....

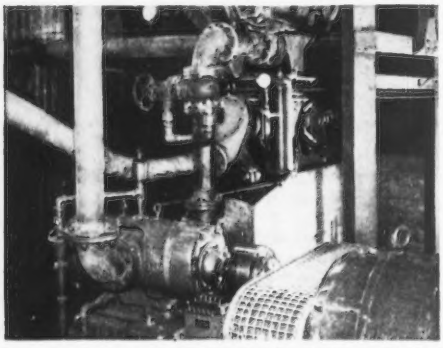
Address.....

State.....





Fuller-Kinyon System handling fly ash in a large central-generating station, from boilers to storage, storage to loading hopper. See drawing upper left.



Fuller-Kinyon System handling hot flue dust from Cottrell precipitator collecting hoppers to supply bin. F-H Airslides convey and distribute uniformly to roasters. See drawing upper right.

The best way to solve any problem of conveying dry pulverized materials is to "Start from Scratch." Get all the facts on pneumatic conveying systems while you are still in the planning stage ... either when building a new plant or modernizing an old one. Pneumatic conveyors permit economy and convenience in location of buildings and production equipment without the restrictions or straight-line limitations of mechanical conveyors. The layout of the system can be designed to meet the specific requirements of the job, to conform exactly to local conditions, to insure minimum cost for erection, maintenance, and supervision.

Right there is where Fuller comes into the picture. As engineers and builders of four basic types of pneumatic conveying systems, Fuller is able to provide the exact system best suited to individual requirements. Shown are two Fuller-Kinyon Conveying Systems—one for handling fly ash from boilers, the other for hot flue dust from Cottrell precipitators.

Fuller-Kinyon Systems have many advantages: conveying lines can be located anywhere—underground; suspended on simple hangers overhead; vertically; around corners; over long distances; and to practically any number of delivery points. There are no mechanical or explosion hazards. Conveying is clean, fast, and at minimum cost per ton of material handled.

We invite you to have Fuller engineers make a study of your plant plans—investigate conditions and the material to be handled. Then they can make recommendations as to the system best adapted to your needs—enable you to save time, money, and material by having both plant and system built at the same time. To consult them places you under no obligation.

FULLER COMPANY—CATASAUQUA, PA.

Branch offices

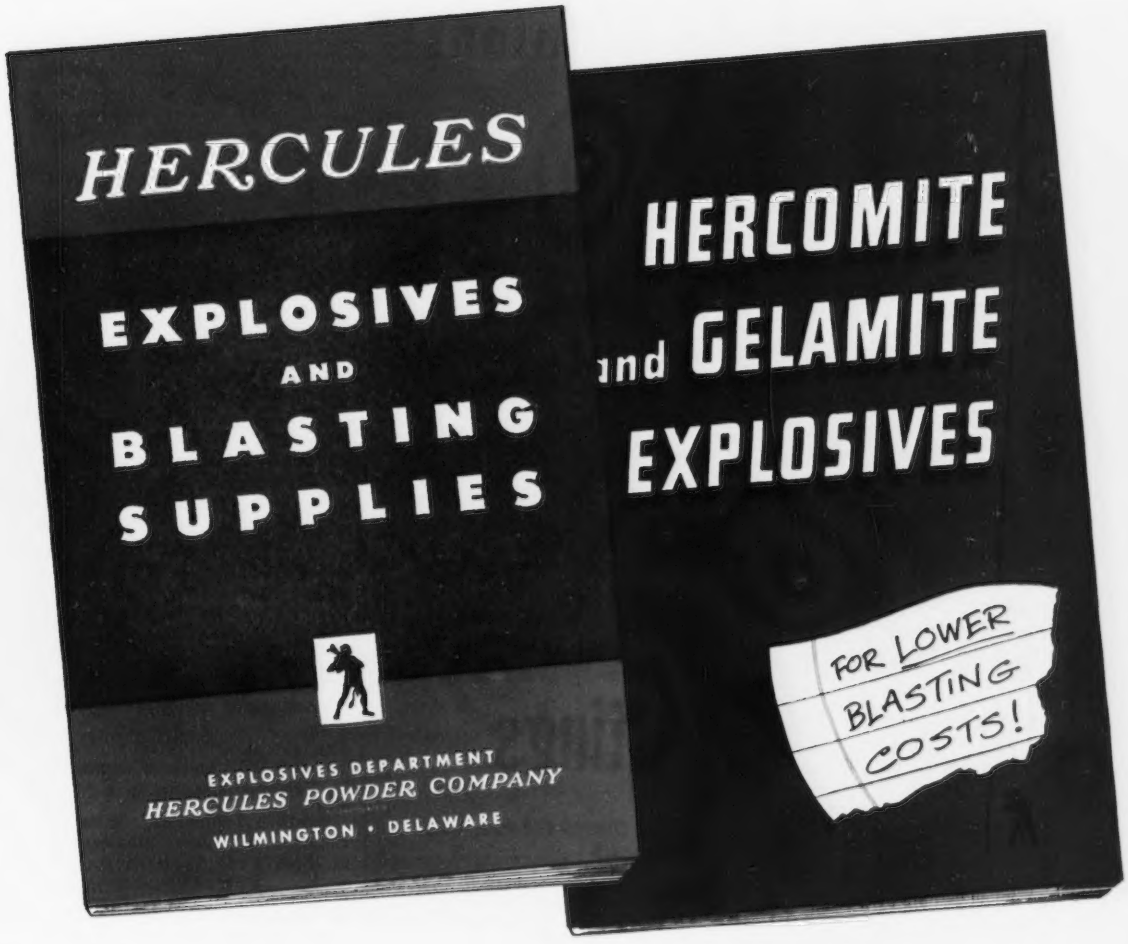
Chicago—San Francisco—Los Angeles—Seattle—Birmingham

Fuller

DRY MATERIAL CONVEYING SYSTEMS AND COOLERS — COMPRESSORS AND VACUUM PUMPS — FEEDERS, AND ASSOCIATED EQUIPMENT

P-149
2112

Explosives Up-To-Date



New Booklets Just Off The Press

Here's the latest information on Hercules' complete line of explosives and blasting supplies . . . a total of 80 pages of valuable data on these products for mining, quarrying, construction, and seismic exploration. If you use explosives in any way, these two new booklets are a "must" for your engineering and purchasing departments. Write for free copies to:

Explosives Department

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fitting companions

that make a happy couple

GRUVAGRIP

couplings and fittings

Gruvagrips are rugged, low cost couplings for grooved end pipe. Easy to apply and remove. Just 3 parts—synthetic rubber gasket and twin iron housings held by 2 bolts. Can be used over and over on 1½" to 14" grooved end pipe carrying air, gases, water, oil, chemicals, pulverized minerals, etc. **Gruvagrips** permit misalignment, allow for shock, end pull, vibration, up to 7° deflection.

Gruvagrip fittings. Long life and free flow are built into tough, shockproof metal. Sections are perfect circles inside and out. 100% reusable. Rust inhibitor prime coat. Sizes—¾" to 12".

Your supply houses carry **Gruvagrips** and a complete line of **Gruvagrip fittings.** Look them over this week, or write the manufacturer for full descriptions, list of users and prices.

Use plain end pipe? Write for information on Rolagrips, strong, light; handy couplings for plain end pipe.

GUSTIN-BACON MANUFACTURING CO.

210 West Tenth Street Kansas City, Missouri

Australia *(Continued)*

Mt. Lyell Mining & Railway Co. Project: Expansion of open cuts to increase mine's life at Queenstown, Tasmania. Cost: About £2-million (Austr.). Product: Copper and pyrite. Present ore reserves: 28½-million tons averaging 0.7% copper. A copper concentrate containing 24% copper, and a pyrite concentrate containing 48% copper, are produced in the mill. The copper concentrates are smelted and refined electrolytically. Refined copper output is to be raised from 7,000 tons per year to 11,000 tons per year if there is no appreciable drop in the price of copper. Pyrite concentrate output is to be stepped up to 80,000 tons a year from the present 60,000 tons per year.

Mt. Morgan, Ltd. Project: Expansion and large-scale stripping at Mt. Morgan, Queensland. Products: Gold, copper, pyrites. Capital expenditures: £2-million (Austr.) over the next few years. Plans for expansion involve large-scale pit stripping, and increase in pyrite concentrates from 60,000 tons a year to 180,000 tons per year.

Zinc Corporation, Ltd. Project: Expansion of lead-zinc ore treatment plant at Broken Hill. Rate: Present ore treatment rate is 500,000 tons per year. This will be increased to 710,000 tons per year by 1956. Expenditures involved: £2.1 million.

Zinc Corporation, Ltd. Project: Production of uranium ore in the Rum Jungle area of Northern Territory. The company is also trying to get uranium production rights in the Radium Hill area in South Australia.

South Australian Mines Dept. Project: Uranium treatment plant at Port Pirie to treat Radium Hill ores. Cost: £1.5-million (Austr.). Money will come from Export-Import Bank. After chemical treatment concentrates will go to the U. S.

New Broken Hill Consolidated, Ltd. Project: Expansion of milling capacity from 200,000 tons of ore per year to 500,000 tons per year by 1956 at Broken Hill, New South Wales.

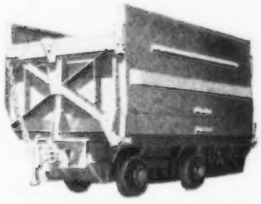
Australian Aluminum Production Co. Project: Aluminum plant at Bell Bay, Tasmania. Cost of project: £7.3-million (Austr.). The plant will start operations on imported bauxite, and later blend imported bauxite with lower grade Australian bauxite. Starting date: 1954. Main problem now is to obtain sufficient electrical power for the plant.

Broken Hill Pty. Co., Ltd. Project: Expansion of iron ore output at Yampi Sound, Western Australia. Present production is 500,000 tons a year.

Electrolytic Zinc Co. of Australia. Project: Increase in milling capacity at Roseberry, Tasmania. Present milling capacity is 160,000 tons per year. This will be increased to 250,000 tons per year.

for a safe, smooth ride . . .

THAT'S what this Lake Shore Man Haul car (above) gives 30 men . . . a dry, safe, comfortable, upright ride with plenty of knee and headroom — space on the seats for dinner boxes. Enclosed design gives men full protection. Available insulated against electricity. Car equipped with full universal oscillating trucks, or conventional type.



for heavy loads and rough service . . .

250 cubic feet — the capacity of this tough, all-welded Lake Shore Granby type side dump car . . . designed for the extremely hard loading and operating conditions met in modern, high-production mining.

a standard of reliability . . .

This 38 cubic foot Lake Shore Standard side dump car has given years of trouble-free service in mines all over the country. Time-tested, simple, sturdy design.

Write for more information on Lake Shore "job-proven" Mine Cars and Mine Equipment.

Standard and Special
Mining-Milling Machinery for Every Application.

LOHED MINE CARS

JETO BOTTOM DUMP SKIP

BICYCLE SHEAVES

LAKE SHORE Engineering Company
IRON MOUNTAIN MICHIGAN

INDUSTRY NEWS IN BRIEF . . .

SANTA FE TANK & TOWER COMPANY SHOWS FLEXIBILITY OF WOOD TANKS FOR MINING OPERATIONS

Wood storage tanks have long served as standard equipment for the mining industry. And with the rapid progress of mining, the ever-efficient wood tank continues to play an increasingly important role.

The Santa Fe Tank & Tower Company, Los Angeles, has devoted no less than 50 years to this field. As one of the leading authorities in wood engineering, Santa Fe has succeeded in developing wood tanks to their *maximum* potential. They have multiplied the uses for wood tanks in mining operations by offering *flexibility* in sizes, shapes and field erection. Actually, the capacities of wood tanks are almost limitless . . . measuring, for example, from 50 gallons to almost 2 million gallons in capacity. These tanks are built in many shapes, according to customer requirements. The diameters likewise vary from 2 feet to as much as 120 feet, or even more. Santa Fe engineers emphasize that "there is almost no limit to what can be done with wood tank construction." They have also been found to be easily *dismantled,* and then *re-erected* in other localities.

Wood tanks are now universally accepted for almost all mining operations . . . gold, silver, copper, uranium, to mention a few. For the storage of water, acid solution, leaching plants and other mining operations, wood tanks are desirable for their resistance to corrosion. Serving almost any storage purpose, they have the ability to withstand constant use for many years. Maintenance costs are generally very low, particularly since painting is not required.

The installations shown here were designed and fabricated by the Santa Fe Tank and Tower Company. Additional information (Mining Bulletin M-45) is available by writing Santa Fe, 5401 S. Boyle Ave., Los Angeles 58, California. Engineering data is also available on Wood Pipe, Cooling Towers, Cylindrical Gas Scrubbers, and other industrial wood specialties. Santa Fe maintains branch offices in all principal cities.

Australia *(Continued)*

King Island Scheelite, Ltd. Project: Increase in mill capacity. Present throughput is 4,000 tons per week. This will be increased to 5,000 tons per week. The tungsten concentrates from King Island Scheelite's property are sold to the U. S. and U. K. under long-term contracts.

Victorian Antimony Mines, Ltd. Project: Antimony smelter at Costerfield. The company has constructed a power house, store, laboratory, and antimony smelter which is expected to give Australia its first commercial production of antimony metal. The plant has been designed to treat a wide range of antimony ores which are available in this field. Start of production: July, 1953.

Three new bauxite deposits have been found in Arnhem Land, which could insure supplies for "a few hundred years" to Australia's first aluminium producing plant now being built at Bell Bay, Tasmania.

Previously, it was proposed to import bauxite for the plant. But now, 10-million tons have been proved in one deposit on the Wessel Islands off the north coast of Arnhem Land. Two other deposits on the nearby mainland close to Cape Arhem have not been tested for size, but each is thought bigger than the Wessel Island find. Easy access by sea would permit low-cost extraction and shipment to Tasmania.

IN THE PHILIPPINES

A sympathetic Philippine Congress has approved tax relief measures for the islands' hard-pressed gold mines. The exemptions will save them $2-million a year in indirect imposts. Legislators hope not only to keep operating mines alive but also to encourage dormant prewar mines to go back into production.

As soon as the bill becomes law, gold producers will be exempt from payment of the 17% tax on purchases of foreign exchange for importation of equipment and stores. They will also be exempt from a further tax, called compensating tax, which is collected in the amount of 7% from importer-consumers in lieu of a 7% sales tax. Gold producers will not be totally exempt from an ad valorem tax on their gold production, but this has been reduced to a flat rate of 1.5%.

To attract new mining capital, new or rehabilitated mines will be exempt from payment of corporate income taxes during the first three years of actual commercial production.

Benguet Consolidated at Balatoc has a long-range plan to expand milling capacity from 2,800 tons to 4,000

(Continued on page 288)

MARION 151-M

SEVEN CUBIC YARDS

This Big, Fast, Hard-Hitting Shovel Is Making History in Metal Mining

The seven-cubic-yard dipper of the MARION 151-M is only one indication of the work it can do.

The small-machine cycle time made possible by the world's finest electrical controls makes the 7-yard dipper of the MARION 151-M more productive than you might expect.

The month-after-month dependability of the 151-M, except for routine maintenance, is another big factor in year-long production output.

Don't say "seven isn't enough" until you see what others are doing with the biggest seven-yard performer that ever hit the mine pits.

Some of the biggest companies in mining are 151-M owners. More than half of these owners have two or more 151-M machines. Your nearest MARION District office can show you why.

MARION POWER SHOVEL CO.
MARION, OHIO, U. S. A.

OFFICES AND WAREHOUSES IN ALL PRINCIPAL CITIES

from ¾ cu. yd. to 45 cu. yds.

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More than 45 Years of Filtration Service to the Mining Industry as Measured by

1. variety of filter types available
2. filter area already installed
3. filtration experience
4. world-wide sales and service

It's obvious why Item No. 1 is of immeasurable value to the mining industry . . . to the non-metallic as well as metallic groups. Wouldn't *you* prefer to check your filter requirements against the filter characteristics of not one or two types, but *four* in the continuous vacuum class and *two* in the pressure filter class, each offering distinctly different filtration values? With the wide type selectivity that Oliver United offers, you will obtain maximum filtration efficiency. You will have the *right* filter.

Item No. 2 is not only a measure of world-wide acceptance — and world-wide is right, for Oliver United Filters can be found in every major mining district in the world. It is also suggestive of world-wide service to the industry.

Item No. 3 . . . a factor that hardly can be ignored or minimized whenever the purchase of filters is being considered. Oliver United Engineers have been identified with every filtration development in the mining industry throughout the world. In fact, Oliver United pioneered continuous vacuum filtration in this country. You can find Oliver United equipment in the "tonnage" mills handling every class of ore· gold, silver, copper, lead, zinc, iron, uranium, molybdenum, manganese pyrites. You can also find Oliver United equipment serving the non-metallic mining field: potash, nitrate, salt, sulphur, phosphate rock, clay, sand. Yes, Oliver United Engineers offer broad filtration experience.

As for Item No. 4 . . . this *world-wide service* is assuming greater and greater importance with each passing year, for major mining developments are taking place in many countries of the world, thousands of miles from *any* filter manufacturer's plant. Mining is no longer provincial! Rightly, companies located in the four corners of the earth expect and should be given sales and service facilities within reasonable distance. Even fast round-the-world flights of today cannot balance the advantages of having competent filtration engineers located strategically all over the world and not too far from any major district. Note under our name and address how well this world-wide service has been set-up.

We suggest that you keep this 4 Point Service in mind when in the market for filters. You will want the *best* type filter for your requirements. You will want it selected by competent filtration engineers who know ore filtration and who are backed up by the broadest filtration experience available. You will want to be able to count on service . . . *wherever you are located!* All these you will get from Oliver United.

Would you like to have our general catalog describing Oliver United filters as well as acid handling and slurry pumps for the mining industry? Send for Bulletin 20-M.

U N I T E D

OLIVER DRUM TYPE FILTER *(a continuous vacuum filter)*

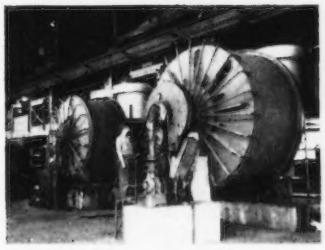
598,000 square feet of filter area installed in the metallic and non-metallic mining industry. The OLIVER is an excellent washing filter, one reason why it is so widely used for cyanide work.

Gold Silver Copper Lead Zinc Molybdenum Uranium

(a continuous vacuum filter) **AMERICAN DISC TYPE FILTER**

208,000 square feet of filter areas installed. This type filter has no equal as a dewatering filter in consideration of the exceptionally high filtering area for the floor space required.

Copper Lead Zinc Iron Flue dust Cement slurry

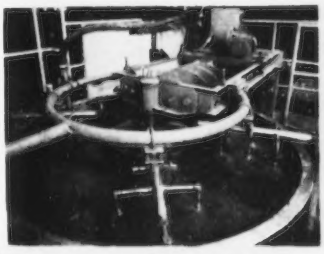


DORRCO "INTERNAL" DRUM FILTER *(a continuous vacuum filter)*

51,000 square feet of filter area installed. Designed for dewatering extra heavy, fast-settling solids, the DORRCO is unique in that the inside of the filter drum forms the tank and solids settle onto the filter cloth rather than away from it. No agitation is required.

Nickel Iron Lead Fluorspar Chrome Gold Aluminum Copper Ilmenite Zinc

(a continuous vacuum filter) **OLIVER HORIZONTAL FILTER**



Relatively a new comer to the line of Oliver United ore handling filters, the Horizontal has already made its mark in the dewatering and washing of crystalline and fibrous products, particularly in the slime free class. It has several extremely useful features. Thick cakes usually are practicable. It has high percentage of effective filter area. No agitation is required. All filtering action and filtrate flow are downward and because of this power consumption is minimized. Counter-current washing possible on a single filter reduces volume of wash.

Phosphate rock Zinc Iron pyrite Feldspar Quartz sand Foundry sand Nitrates Vanadium Coal

Plus

27,000 square feet of Sweetland Pressure Filter area and 20,000 square feet of Kelly Pressure Filter area . . . both being used on refinery and special slurries.

Note: All filter areas noted above are to December 31, 1952.

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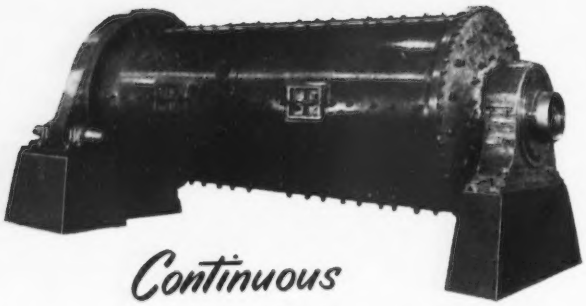
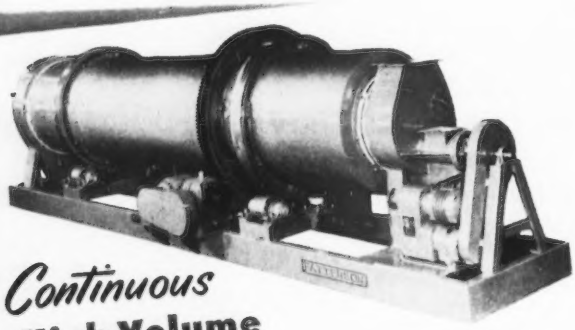


Continuous

Heavy Duty GRINDING

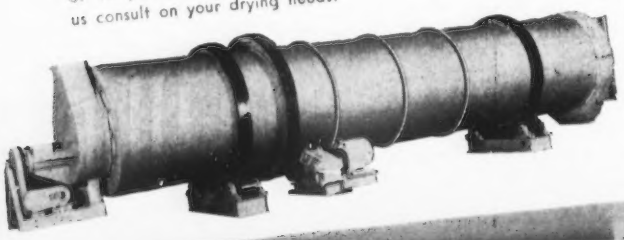
Continuous feed and continuous discharge with the PATTERSON Tube Mill provides steady grinding production under the most rugged conditions—at record lows in cost! **Write us.**



Continuous

High Volume DRYING

PATTERSON Rotary Dryers give you uniform drying of materials with continuous feed and discharge, exact control of temperatures, and excellent operating economy. Let us consult on your drying needs.



The Patterson Foundry and Machine Company
East Liverpool, Ohio, U. S. A.
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The Patterson Foundry and Machine Company, (Canada) Limited
Toronto, Canada
MONTREAL

Philippines *(Continued)*

tons a day, but is not doing anything about it immediately. Benguet Exploration, another mine in this area, is driving a new level, No. 4, 80 ft. below the No. 3 level. It is hoped that when the ore body is cut in this section the existing ore reserve of the mine (10,000 tons of 0.8 oz. gold and 15% zinc) will be doubled.

Acoje Mining is installing additional Humphrey spirals to boost production of concentrates to 5,000 tons a year. Olga Freight & Construction Co. is pushing production of refractory grade chromite at Candelaria, Zambales, from 1,000 tons to 3,000 tons per month. Consolidated Mines is spending about $750,000 on construction of a 3-ft. gage railroad from its Masinloc property to its loading installation at the coast, a distance of 27 km. Two 35-ton Diesel-electric locomotives and one 15-ton switching locomotive have been ordered. Elizalde & Co. are restoring a copper property at Botolan, south of Masinloc. The mill is to have a daily capacity of 100 tons a day. The ore assays from 4% to 5% Cu. Rehabilitation of the Sta. Barbara Mining Co. has reached a stage where the installation of a 100-ton flotation plant will soon have to be taken in hand. The property is worked for gold, lead and zinc. The mine is operated by Demonstration Gold Mines Ltd. under a prewar operating contract.

Philippine Iron Mines at Larap is planning for a daily production of 4,500 tons by January 1, 1955. A program for beneficiation of ore not at present marketable in Japan has been adopted. It calls for installation of a washing plant in conjunction with the operation of a heavy media plant to treat alluvial matter now of no commercial value. A pilot plant of 50-ton capacity for 8 hours' operation is now being installed. The full-scale installation to follow will be capable of producing not less than 1,000 tons of marketable ore per day.

A plant to produce iron ore concentrates will also be installed at Larap. This installation is on order in Japan. It is designed to treat high-sulphur, low-iron ore now of no commercial value. About 10-million tons of such ore are available at the mine. The treatment will produce concentrates with an iron content of not less than 62% and a sulphur content of 1% or less. This plant will have a capacity of 30,000 to 40,000 tons in terms of ore concentrates per month. With this program in operation, the mine will be in an excellent position to meet the keen competition for the Japanese iron ore market among Philippine iron mines. In addition the company has budgeted $166,000 for staff and employee housing.

A. Soriano y Cia., who are the consulting engineers to Philippine Iron Mines, have entered into an operating contract with the latter to develop an

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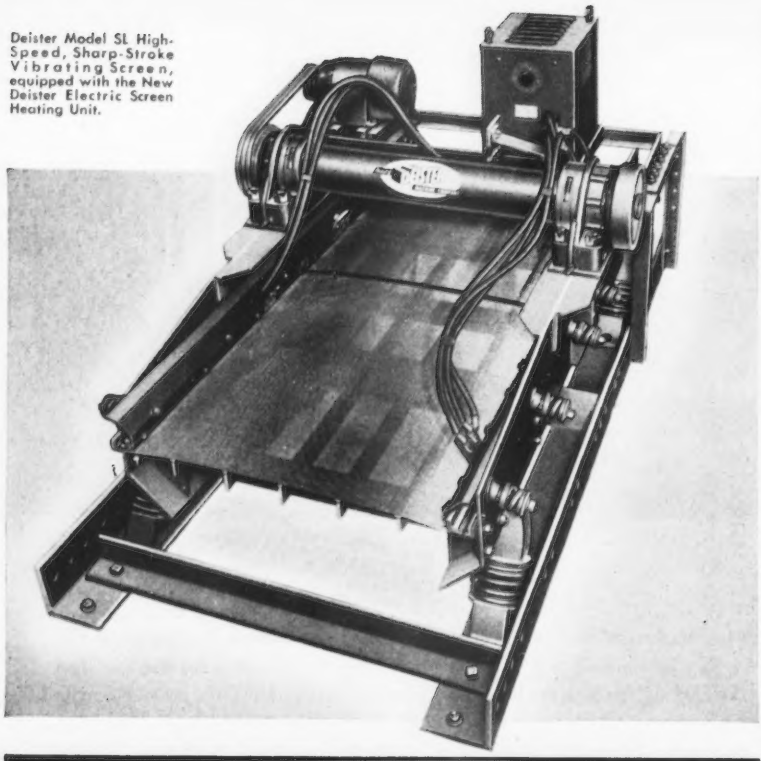
Deister Model SL High-Speed, Sharp-Stroke Vibrating Screen, equipped with the New Deister Electric Screen Heating Unit.



For DAMP, STICKY ORE...

DEISTER SCREENS

High-Speed Sharp-Stroke Screen
With DEISTER Electric Screen Heater

"Improved separation of damp, sticky ore—with increased tonnage per hour"... that's the report from 100% of the users of the new Deister High-Speed Sharp-Stroke Vibrating Screen equipped with Deister Electric Screen Heating Unit.

The Model SL Deister *unitized* vibrating mechanism is engineered for extreme ruggedness, with dead weight *eliminated* to permit the extremely rapid stroke-cycle necessary for maximum separation efficiency of fine, moist materials.

And now, with the new Deister Electric Screen Heating Unit, which relieves the surface of moisture, screen cloths are really kept *open*. Pounding and brushing to remove blinding material is *eliminated, lengthening cloth life up to three times.*

NEW

ORE CONCENTRATING TABLE
with New
DEISTER *Lifetime* HEADMOTION
write for details about the latest development in wet gravity separation and recovery.

DEISTER MACHINE COMPANY
FORT WAYNE 4, INDIANA

Philippines *(Continued)*

iron deposit located near Mati, Davao, Mindanao. The Japanese are interested in this ore, too.

Elizalde & Co. have a second project cooking at Masara, 35 miles northeast of Davao. This prospect was originally under lease to Panaminas, but the concern withdrew two years ago after spending half a million dollars. The ore is said to average 0.4 oz. gold, 1.7% lead, 0.9% copper and 6.7% zinc. Elizalde & Co. is planning an 18 km. private railroad to the mine. Work on a 300 ton a day mill is also to start shortly. The mine will ship copper, lead and zinc concentrates and gold bullion. Expenditure is expected to run to more than $1-million. Masara is also considering the use of hydroelectric power plants by harnessing the water from the Malumon, Wages and Masara creeks.

Relying on consolidation of capital and development of new properties, Masbate Consolidated Mining Company, Antamok Goldfields Mining Company and IXL Mining Company will resume mining operations for the first time since the end of the war, subject to the stockholders' approval.

Proposals which will be submitted for approval include:

1. The name of Masbate Consolidated Mining Company will be changed to Atlas Mining and Development Company, with an increase in capital from $2.5-million to $7.5-million.

2. Atlas will acquire the outstanding stock of the Antamok Goldfields Mining Company and of the IXL Mining Company at net book value, issuing in exchange its own shares.

The reorganized company would thus acquire assets which, together with present holdings, would total $4,-150,000 consisting of investments and cash amounting to over $2,750,000 as well as mining equipment and mining properties with a value of approximately $1,350,000.

The three dormant mining companies have an interest in the New Saza mines in Tanganyika. Atlas Consolidated Mining and Development Company will engage actively in the mining industry in the Philippines. Development of the Toledo copper property in Cebu and the Mati iron property in Davao will start as soon as the reorganization plan is completed.

Exploration work has been in progress on both of these properties for some time. By diamond drilling and adits sufficient tonnage has been proven to warrant establishing plant facilities for mining and processing 2,000 tons daily at each location.

The Toledo copper property is located approximately 35 kilometers west of Cebu. Development of this property was started before the war. During the occupation the Japanese erected a mill on the property and extracted 13,000 tons of ore. After

Low-cost transportation since 1928!

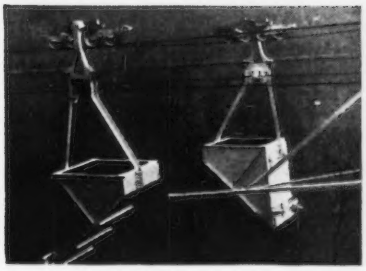
Tasa Coal Company
Morgantown, West Va.

This 3,412-foot bicable tramway has been in continual operation for more than 25 years. It carries 200 tons of coal per hour at low ton-mile cost, giving dependable all-weather service.

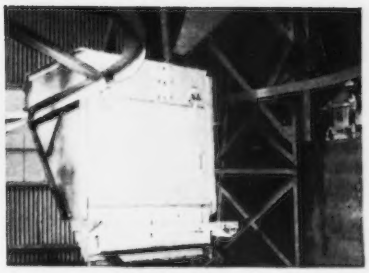
It spans a river in one 1500-ft. jump, crosses a public highway and a high tension line on the way from loading terminal to discharge hopper.

The 62 cu. ft. end-dump buckets load and unload automatically... discharging into a terminal bin at the rate of one every 26 seconds.

This aerial tramway was designed by the Tramway Division of United States Steel. The job included designing and furnishing cables, mechanical buckets, electrical equipment—and supplying all of the steel required.



Conveying materials for a few hundred feet or for several miles, Columbia-Geneva Tramways can be built to handle from 1½ to more than 300 tons hourly. They can be designed to meet almost every type of operating condition, and to handle many kinds of commodities easily and economically—from a tray of optical lenses to a carload of lumber.



Load carriers, like this one on a bicable tramway, are available in many different types and sizes. Services of Columbia-Geneva's Tramway Division include designing the tramway...supplying the steel...excavating for foundations and erecting support structures...furnishing and installing all wire rope, cables, and electrical and mechanical parts.

Tramway support structures are of many types, depending on terrain and job. Because of this flexibility, tramways are free of ground contour, roads, railroads, etc., are unhampered by bad weather, and can climb extremely steep grades. Other advantages: loads can be moved without rehandling and rights-of-way are easier to acquire.

Send for this free manual on aerial tramways. Write on your letterhead today to the Tramway Division, Columbia-Geneva Steel, 141 Battery St., San Francisco 6, Calif. Or for an expert study of your transportation needs, ask for the services of a Tramway Engineer. He can show how an aerial tramway would pay off for you, and he can contract for its design and all phases of its construction, including materials.

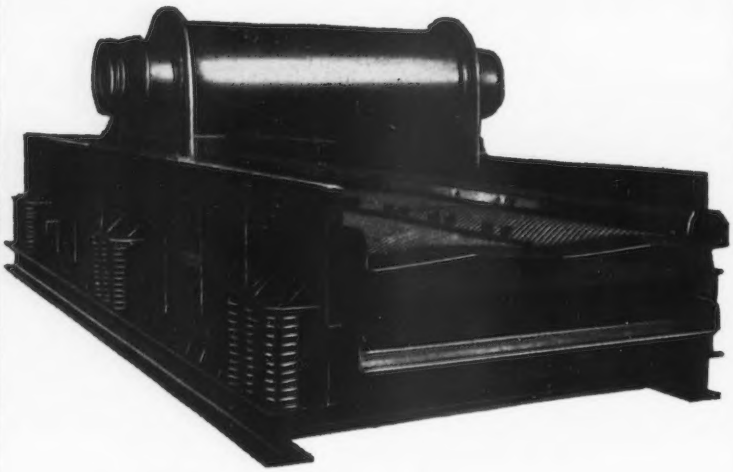
Tramway Division

Columbia-Geneva Steel

Division United States Steel Corporation, San Francisco

USS

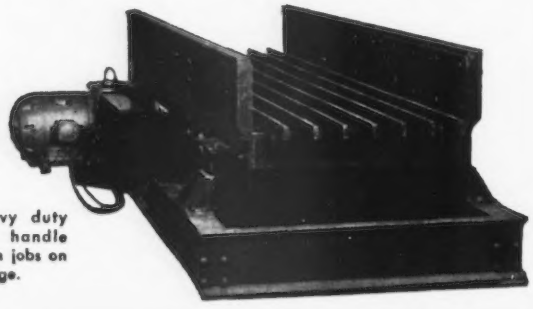
UNITED STATES STEEL



SIMPLICITY gyrating screens are doing a fast, efficient sizing and dewatering job for the metal mining industry

The 6' x 20' Simplicity Model OM Double Deck Screen shown here is typical of Simplicity Screens used successfully at the great Mesabi Range in Minnesota to size and dewater iron ore. This screen, with a ⅜" opening on the top deck and a 1½mm. dewatering surface on the lower deck, is designed for heavy media concentration of iron ore.

Throughout the metal mining industry, Simplicity equipment is handling all types of preparation work from coarse scalping to fine screening and dewatering. Simplicity operating mechanism insures fast, accurate sizing and keeps production costs down.



Simplicity heavy duty scalpers also handle tough production jobs on the Mesabi Range.

Simplicity
TRADE MARK REGISTERED

ENGINEERING CO. • DURAND, MICHIGAN

Sales representatives in all parts of the U.S.A.
FOR CANADA: Canadian Bridge Engineering Co., Ltd., Walkerville, Ontario
FOR EXPORT: Brown and Sites, 50 Church Street, New York 7, N. Y.

113

Philippines *(Continued)*

the war, the property was acquired by a group of investors associated with the Mindanao Mother Lode Mining Company. This group, in turn, in 1952 gave A. Soriano y Cia. an option to explore with rights to develop the property under an operating agreement.

The Masbate Consolidated Mining Company has sufficient equipment at its Masbate mill, with the exception of a flotation circuit, to justify installation of a 2,000-ton Toledo mill. In addition to equipment now owned by the company, approximately $1,750,000 will be invested in the plant at Toledo. A group of Japanese buyers of ore has agreed to advance $750,000 in the form of equipment for developing the mine, the advance payment to be repaid in copper.

The Mati Iron claims are held by A. Soriano y Cia. under an operating agreement with the claim owners. The development and operation of this iron mine will be turned over to the Atlas organization. Japanese interests are negotiating to buy 720,000 tons of iron ore annually from this property at an average price of $8.50 per ton for 60% ore, with an advance payment of $1.5-million to help in developing the property.

The reorganized company will also push exploration work at a number of other prospects in addition to work contemplated at the Toledo and Mati properties.

Boom Times in Diamonds Ends, Sir Ernest Says

IT WAS UNTRUE that diamond producers held huge stocks of diamonds to maintain artificially high prices, Sir Ernest Oppenheimer, chairman of De Beers Consolidated Mines, told stockholders. It was also untrue, he said, that producing companies mined in a way which would restrict production and cause shortages.

"Boom times in the diamond trade had ended," he declared, "and a reduction in sales of both gem and industrial diamonds must be expected. Gem sales for the first five months of 1953 amounted to £21,000,000, about the same as in the first five months of 1952. Some reduction was expected during the rest of 1953 but the year as a whole would be a satisfactory year for gem business.

"Sales of industrial diamonds dropped from £11,800,000 in the first five months of last year to £6,700,000 in the first five months of this year. This was not due to a reduction of consumption but to the cessation of stockpiling by the United States and other governments.

"De Beers sales of industrial diamonds for drilling had been adversely affected by an increase of the Gold Coast African Chief's production.

(Continued on page 296)

IT'S THE "GIVE" in O-B Couplers that Protects Mine Cars

Restrained slack between mine cars permits cars equipped with O-B Automatic Couplers to stand off the worst sort of mine haulage punishment. This slack comes from rubber pads which compress — or give — to absorb blows, but which also expand again to keep all coupler parts bearing firmly on one another. No part of an O-B Coupler can flop about loosely—engaged or unengaged.

These rubber pads form the draft gear of O-B Automatic Couplers. They give when necessary; they always regain their original shape; they hold unengaged couplers ready to join with mating heads.

Restrained slack protects and prolongs car life when O-B Automatic Mine Car Couplers are in use. That's one pretty good reason for choosing O-B for your new or remodeled cars!

O-B Automatic Mine Car Couplers on these 30-ton mine cars give protection from haulage jolts and jerks by absorbing that punishment in durable rubber draft gear.

4351-M

USED TO DESTRUCTION...NO RESHARPENING

Liddicoat

...the bit that drills farther, faster, for less

Liddicoat detachable bits are used to destruction and then discarded. The strong connection — no threads — provides good steel life and makes the changing of bits quick and easy. No delays, no resharpening, no extra costs.

With Liddicoat's low initial cost, you obtain lowest cost per foot of hole drilled.

Liddicoat bits actually chip out the rock instead of battering it until pulverized as is the case with ordinary conventional bits. The two-stage cutting portions for the life of the bit are the principal reasons for this stand-out performance of Liddicoat. The cutting edges are shaped for drilling speed and the reaming edges for long use.

Many of the world's most important mining and contracting companies have turned to Liddicoat for superior performance . . . Join this ever expanding list of satisfied Liddicoat customers.

TEE CEE

(TUNGSTEN CARBIDE INSERT) BIT . . . designed for on-the-job interchange with the famed Liddicoat bit that is "used to destruction."

TEE CEE and "Single Use" bits both fit the same drill steel

WESTERN
Rock Bit Manufacturing Company
552 West 7th South • Salt Lake City 4, Utah

"Every Little Bit Counts"

DEMONSTRATED...SOLD...REORDERED!

"Eucs"

Maintain 87% Job Availability at Norway Mine!

AT Sydvaranger iron mine in Norway, a Model TD 22-ton Rear-Dump "Euc" on demonstration worked with a fleet of tractor-trailer units of other make. Performance of this "Euc" and its 25% greater job availability was so impressive that seven additional Rear-Dump Euclids were purchased . . . the original hauling fleet is being replaced or converted to other use.

Working 24 hours a day, 6 days a week, the year 'round, "Eucs" at Sydvaranger have averaged 87% job availability including time required for periodic servicing and installation of special equipment. They are loaded with iron ore and heavy overburden by a 4½ yd. shovel, and have a round trip haul of about 3½ miles.

The simple but rugged design of job-proved "Eucs" is paying off at this mining operation 400 miles north of the Arctic Circle just as it is on hundreds of other mine, quarry and earth moving jobs throughout the world. Have your Euclid Distributor provide a hauling production and cost estimate based on the use of Euclids for your work . . . there's no cost or obligation.

The EUCLID ROAD MACHINERY Co.
Cleveland 17, Ohio

EUCLID (GREAT BRITAIN) LTD. • GLASGOW, SCOTLAND

CABLE ADDRESS: YUKLID

CODE: BENTLEY

Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

NOW! LATTICE BRAID* PACKING WITH TEFLON†

Heavy Teflon impregnation throughout
Choice of Canadian white asbestos or blue African asbestos
Unique LATTICE BRAID construction

An Exclusive GARLOCK Shaft and Rod Packing

LATTICE BRAID packing (a patented Garlock product) is braided through and through to give it strength, flexibility, resiliency, and long life. Teflon (a du Pont product) is unaffected by caustics, process liquids, solvents, acids or chemicals of any kind.

Garlock combines these two products by impregnating each strand of LATTICE BRAID asbestos packing with Teflon suspensoid. The result is a sturdy braided asbestos packing with a heavy, thoroughly distributed Teflon impregnation which is unaffected by the liquid being handled. This long-life packing has a low coefficient of friction, is non-corrosive and non-contaminating.

LATTICE BRAID with Teflon is available in either Canadian white asbestos (Style 5861) or blue African asbestos (Style 5880). Garlock also manufactures all-Teflon LATTICE BRAID packing, plastic packings of shredded Teflon, and other Teflon products.

For complete information, write us or contact your Garlock representative.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.
Branch Offices in Most Principal Cities

*REGISTERED TRADEMARK
†The Du Pont Company's Trademark

GARLOCK
PACKINGS, GASKETS, OIL SEALS,
MECHANICAL SEALS,
RUBBER EXPANSION JOINTS

Diamonds *(Continued)*

There was at present an oversupply of industrial diamonds for drilling, and sales without regard to market needs had led to uneconomic prices for West African output. De Beers sales had suffered because it refused to follow the downward trend of prices. We are always ready to discuss this problem with the West African authorities in the hope that mutually satisfactory arrangements can be arrived at."

INDIA

Metal Corporation of India Limited, Calcutta. Projects: Mill at Zawar, Udaipur Rajasthan. Lead smelter at Tandu (via) Katrasgarh, Bihar. Investment: $1-million. Products: Lead-zinc. Grade of ore: Pb 5%, Zn 7%. Mining rate: 200 tons per day, going up to 500 tons per day in the next five years. Starting date: 1953-54.

Technical facts: Mining—At present mining on the 1st level 106-ft. depth. In six years to go to the 6th level, 600 ft. below. Equipment—Compressor plant of 2,000 cfm, to be increased to 5,000 cfm. Installation will require power loaders, more hoists and 63 pneumatic drills. Lead is smelted in their own smelter, the zinc at present going to a smelter in Belgium. The company has received a $600,000 loan from the Government of India and will receive more help. The Government may put up a zinc smelter here also.

Indian Copper Corp. Ltd., Ghatsila (producing since 1928). Projects: Mines at Mosabhoni and other places. Smelter at Ghatsila. Investment: $2-million. Products: Copper (fire-refined) 99.4% copper, yellow metal sheet 60/40 hot rolled. Grade of ore: 2% copper. Expansion plans: Electrolytic copper plant under consideration. Technical facts: The copper-bearing mineral is concentrated by flotation. The concentrate, which contains 25% copper, is then sent to the smelter. This is the only copper smelter in India.

India's aluminum industry is making steady progress on its expansion program to raise rated capacity for primary ingots from 4,000 tons in 1951 to 20,000 tons by the end of 1956. Investments involved are estimated at about 90-million rupees.

The Indian Aluminium Co. here is examining the possibility of setting up a 10,000-ton smelter in the vicinity of the Hirakud project and has applied to the Government for a license. Work on the expansion of the company's smelter at Travancore from 2,500 to 5,000 tons annually is expected to be finished by the middle of 1954, while extensions to the rolling mill at Belur in West Bengal are scheduled for completion by the end of this year.

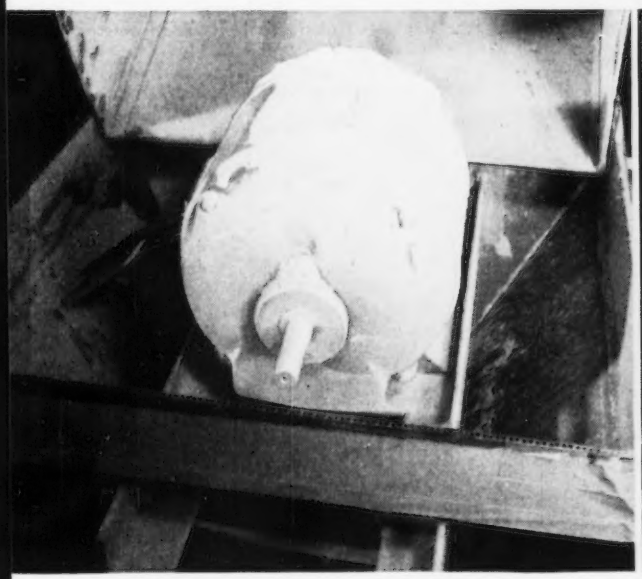
Tests Like This Show The Stamina of R & M "All-Weather"* Motors!

The standard R & M "All-Weather" open motor shown below was placed in a specially built test chamber in which it was blasted with highly abrasive 200-mesh powdered quartz.

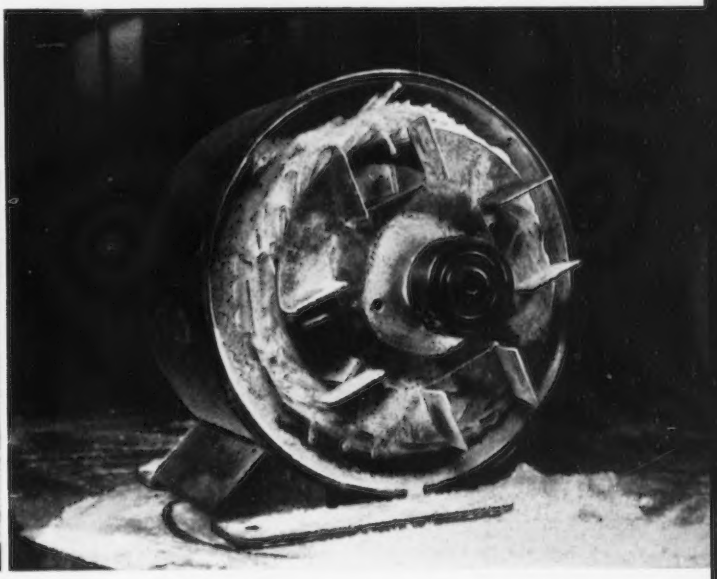
After 2,860 hours continuous operation, it was torn down for examination. In spite of the tremendous amount of quartz deposited by air circulating through the motor, this is what was found: insulation showed no damage; effective thru-ventilation had kept all air-passages clear and unblocked; grease in the fully-sealed pre-lubricated ball bearings was not contaminated—effective bearing seals had kept grease in, abrasive out.

After 8,000 hours in this "snow storm" of quartz the motor is still going strong, even though this accelerated test is subjecting it to treatment that would *never be encountered* in normal applications.

This is the kind of stamina *you can expect* with R & M Motors working for you . . . this is the performance for which R & M "All-Weather" Motors are famous!



This R & M "open" type motor has operated 8066 hours while being blasted with highly abrasive powdered quartz.



Large deposits of quartz were found throughout the motor, yet insulation is sound, bearings are clean.

R & M Explosion-Proof Motor

Robbins & Myers makes a complete line of Open-Protected Motors to 125 h.p.; Totally Enclosed and Explosion-Proof Motors from ½ to 40 h.p. If you're looking for the one motor ideally suited for mining applications—if motor failure is costing you money, write for R & M Bulletin 505 *today*. It tells why R & M "All-Weather" Motors stand up where others fail—shows you all the "extras" R & M offers *at standard prices!*

ROBBINS & MYERS, INC.
Industrial Motor Division, Springfield 99, Ohio **EMJ-73**

Please send me *without obligation* Bulletin 505, R & M "All-Weather" Explosion-Proof Motors.

Name _____ *Title* _____

Company _____

Address _____

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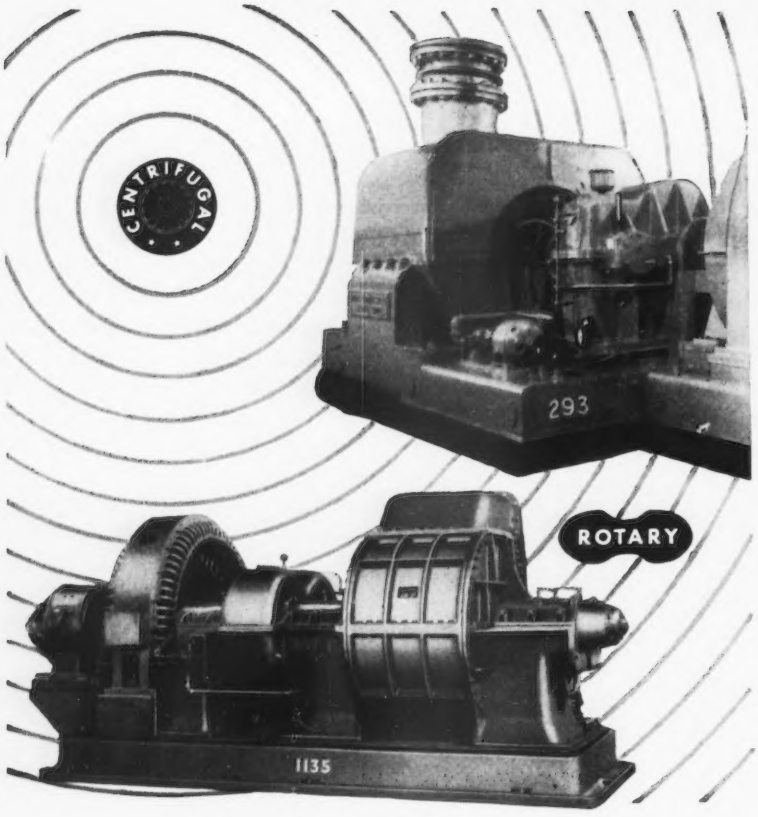
ROBBINS & MYERS, INC.

SPRINGFIELD 99, OHIO • BRANTFORD, ONTARIO

*"All-Weather" is a Robbins & Myers trademark



ONLY THE BLOWER *Specialists*
BUILD THE DUAL-ABILITY LINE

To meet the varying problems of handling air or gas, in industrial processes, Roots-Connersville builds two complete lines of blowers and exhausters—Rotary Positive and Centrifugal. Together, they cover capacity requirements from 5 cfm to 100,000 cfm in single units. Centrifugals are available in multi-stage units, as illustrated, or in single-stage types.

Thus, this exclusive *dual-ability line* permits selection (without prejudice as to types) to meet the needs of most moderate pressure applications. Regardless of their sizes or types, R-C Blowers are unmatched in reliability, operating economy and long-time performance. Built into them is almost a century of specialized experience in handling gas and air, which is our exclusive business.

In addition to blowers and exhausters, R-C products include a wide range of gas and vacuum pumps, meters, inert gas generators and other related equipment. So, whenever you have a need for moving or measuring gas or air, we suggest consultation with the R-C Specialists.

ROOTS-CONNERSVILLE
Exclusive Specialists in Handling Gas and Air

ROOTS-CONNERSVILLE BLOWER A DIVISION OF DRESSER INDUSTRIES, INC.
537 Washington Ave.• Connersville, Indiana

India *(Continued)*

Shivrajpur Syndicate Ltd. Project: Manganese mine 23 miles from Champaner Road Station, Western Railway. Product: Manganese ore, 40 to 52% MnO_2 content. Extent: 1,330 acres. Production rate: Present, 6,000 tons per month. Proved reserves: 300,000 tons. Plans: Three-year development schedule, 1953-56. About 80% of products go to U. S. A.

Chowgule & Co. (largest in Portugese India). Project: Iron mine at Biocholin, Goa (Portugese India). Production rate: 500,000 tons iron ore per year. Plans: Hope to double output in two years. Large loan has already been repaid to Japan. Japan buys most of the output and is vitally interested in the mine development.

Seth Gopikisan Agrawal. Project: Maganese mine at Tumser (Madhya Pradesh, Central India). Production rate: Increased from 35,000 tons in 1950 to 60,000 tons in 1951. Expected to increase production to 100,000 tons per year. Sells exclusively to the U. S. Latest offer: $28 per ton f.o.b. mine for 44% ore.

Seth Gopichand Sharma. Project: Open-pit manganese mine in Tumser-Tirodi area, Madhya Pradesh (Central India). Grade of ore: Low-grade. Estimated yield: 76,000 tons annually, to be increased to 100,000 tons in two years. Plans: Importation of compressors and rock drills to step up output.

JAPAN

Oage Mining Co. Project: Ainai copper mine, Akita prefecture. Investment: $278,000. Grade of ore: 1.2%. Rate: 150 tons of ore per day. Starting date: Dec. 1952.

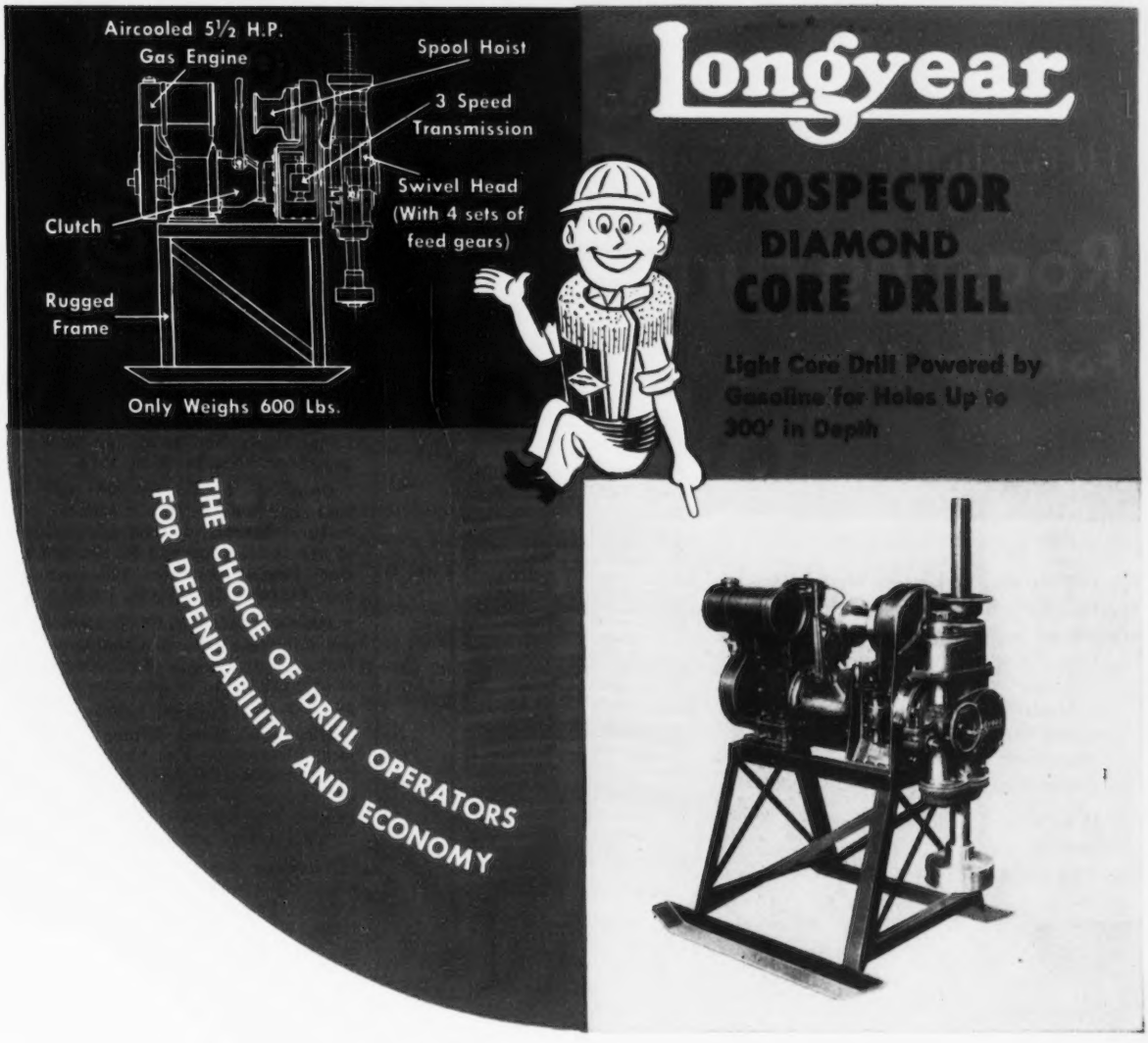
Dowa Mining Co. Project: Electrolytic copper and zinc plant at Kosaka, Akita prefecture. Investment: $1.95-million. Capacity: 200 tons of copper ore and 310 tons of zinc ore per month. Starting date: Nov. 1952. Fluo-Solids roasters are employed.

Sumitomo Metal Mining Co. Project: Lead blast furnace at Kunitomi, Hokkaido. Investment: $184,000. Capacity: 750 tons of lead ore per month. Starting date: Jan. 1952.

Furukawa Mining Co. Project: Electrolytic lead plant expansion at Ashio, Tochigi prefecture. Investment: $13,900. Capacity: 65 tons of lead and 36 tons of electrolytic lead per month. Starting date: May 1952. Electric furnaces are employed.

Nihon Mining Co. Project: New copper-zinc mine at Kamikita, Aomori prefecture. Investment: $834,000. Grade of ore: 1.84% copper, 1.7% zinc. Production rate: 200 tons of ore per day. Starting date: Mar. 1954.

Sumitomo Metal Mining Co. Project: Copper mine at Yoichi, Hokkaido. Investment: $236,000. Grade of


Aircooled 5½ H.P. Gas Engine
Spool Hoist
3 Speed Transmission
Swivel Head (With 4 sets of feed gears)
Clutch
Rugged Frame
Only Weighs 600 Lbs.
Longyear
PROSPECTOR DIAMOND CORE DRILL
Light Core Drill Powered by Gasoline for Holes Up to 300' in Depth
THE CHOICE OF DRILL OPERATORS FOR DEPENDABILITY AND ECONOMY

Engineering Advancements Assure Outstanding Performance

Cores Tell The Story . . .

Longyear Prospector Core Drills are built for long, economical and trouble-free service. The gasoline driven Prospector is designed for drilling from surface and is ideally suited for sinking shallow standpipe, and for core drilling after bed rock is reached. Drills can be mounted on truck, trailer or jeep. Industrially, this model may be used in testing foundation sites for bridges, dams and power installations. Prospector Drills are also available in electric and air driven models. Write today and let us tell you how we can best serve your needs.

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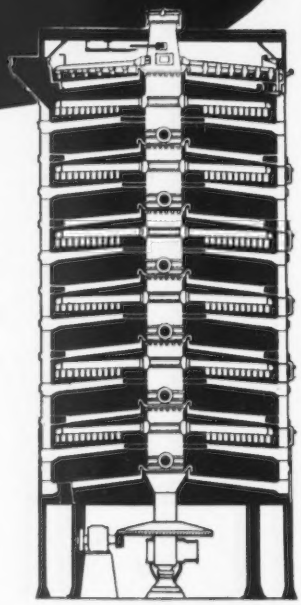
DIAMOND CORE DRILLS • CONTRACT CORE DRILLING
SHAFT SINKING • GEOLOGICAL INVESTIGATIONS

REPRESENTATIVES IN PRINCIPAL MINING CENTERS IN THE UNITED STATES AND OTHER COUNTRIES

Nichols Herreshoff* • Bethlehem Wedge*

Roasting Furnaces

For the Mining Industry



Nichols and Bethlehem Wedge Multiple Hearth Furnaces are widely employed by the world's mining industries in many diverse applications involving both metallic and non-metallic minerals. Exclusive design features providing furnace adaptability to different processing requirements make these furnaces efficient and economical.

In addition to equipment, Nichols offers complete engineering services, from research to plant operation.

* Reg. U. S. Pat. Off.

Roasting..

Nichols-Wedge furnaces are being used to roast ores and concentrates for the manufacture of acids and/or the production of zinc, copper, molybdenum, nickel, cobalt, tungsten, mercury, etc.

Calcining..

In the non-metallic field, Nichols-Wedge furnaces are successfully drying and calcining limestone fines, gypsum, kaolin, phosphate rock, soda products, vermiculite, bauxite, fullers earth and diatomaceous earth, among other materials.

Drying..

We maintain completely equipped and staffed facilities for custom roasting and pilot-plant testing operations.

Write for Bulletin No. 224

Nichols Engineering & Research Corp.

70 PINE ST., NEW YORK 5, N. Y.
1637 N. Illinois St., Indianapolis, Ind.
40 S. Los Robles Ave., Pasadena 2, Calif.
1477 Sherbrooke St., W., Montreal 25, Canada

Japan *(Continued)*

ore: 1.5%. Production rate: 250 tons per day. Starting date: Aug. 1954.

Chugai Mining Co. Project: Lead-zinc-manganese mine at Yakumo, Hokkaido. Investment: $242,000. Grade of ore: 2.5% lead, 5.0% zinc, 24% manganese. Production rate: 80 tons of ore per day. Starting date: Nov. 1953.

Chugai Mining Co. Project: Copper-zinc mine at Tsumo, Shimane prefecture. Investment: $258,000. Grade of ore: 1.1% copper, 4.0% zinc. Production rate: 150 tons of ore per day. Starting date: Oct. 1954.

Toho Zinc Co. Project: Copper mine at Okura, Yamagata prefecture. Investment: $833,000. Grade of ore: 2.5%. Production rate: 120 tons per day. Starting date: Mar. 1954.

Oppu Mining Co. Project: Copper-lead-zinc mine at Oppu, Aomori prefecture. Investment: $416,000. Grade of ore: 1.4% copper, 1.8% lead, 5.0% zinc. Production rate: 150 tons per day. Starting date: Sept. 1954.

Ishiwara Industry Co. Project: Copper mine at Myoho, Wakayama prefecture. Investment: $466,000. Grade of ore: 1.6%. Production rate: 300 tons per day. Starting date: Apr. 1953.

Mitsubishi Metal Mining Co. Project: Electrolytic zinc plant at Akita, Akita prefecture. Investment: $378,000. Capacity: 560 tons of ore per month. Starting date: Oct. 1953. Fluo-Solids roasters are employed.

Nitchitsu Mining Co. Project: Zinc distilling plant expansion at Mikkaichi, Toyama prefecture. Investment: $97,400. Capacity: 450 tons of ore per month. Starting date: Jan. 1954. The St. Joseph process is employed.

Mitsui Metal Mining Co. Project: Zinc distilling plant at Miike, Fukuoka prefecture. Investment: $362,000. Capacity: 500 tons of ore per month. Starting date: Sept. 1953. Vertical retort distillation is employed.

Mitsui Metal Mining Co. Project: Zinc distilling plant at Miike, Fukuoka prefecture. Investment: $106,000. Capacity: 500 tons of ore per month. Starting date: Sept. 1955. Vertical retort distillation is employed.

Fujikoshi Mining Co. Project: Iron-copper-nickel plant at Tsuruga, Fukui perfecture. Investment: $582,000. Capacity: 25 tons of ore per month. Starting date: Oct. 1953. B. S. A. F. furnace roasting and smelting are employed.

Budo Mining Co. Project: Electrolytic zinc plant expansion at Tokyo. Investment: $20,400. Capacity: 125 tons of ore per month. Starting date: Jan. 1953.

Toho Zinc Co. Project: Zinc distilling plant expansion at Annaka, Gumma prefecture. Investment: $87,700. Capacity: 200 tons of ore per month.

(Continued on page 307)

puzzled about handling costs?

then consult **BROWNHOIST**

Railroads, steel mills, mines, docks and large manufacturing plants can cut costs and speed materials handling with BROWNHOIST equipment. BROWNHOIST builds boat unloaders, fast plants, traveling bridge cranes, storage bridges, shipyard cranes, car dumpers, locomotive cranes and related machinery to handle bulk materials in large quantities rapidly and efficiently. The traveling ore bridge shown here, for example, can unload and stockpile approximately 600 tons of iron ore per hour.

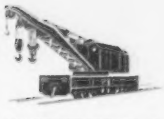
This Traveling Ore Bridge helped one large manufacturer cut the cost of unloading shipments of ore from Great Lakes' vessels. It has a span of 234 ft., a raisable apron extending 88 ft. from the center of the pier leg and a fixed cantilever 55 ft. on the shear end. It is equipped with Brown patent ore buckets.

BROWNHOIST equipment is built in capacities to meet virtually every bulk materials handling requirement. If you want to save production time and money, it will pay you to consult your nearest BROWNHOIST representative or write us today for complete information.

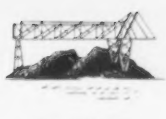
170

BROWNHOIST
builds better cranes

CLAMSHELL BUCKET



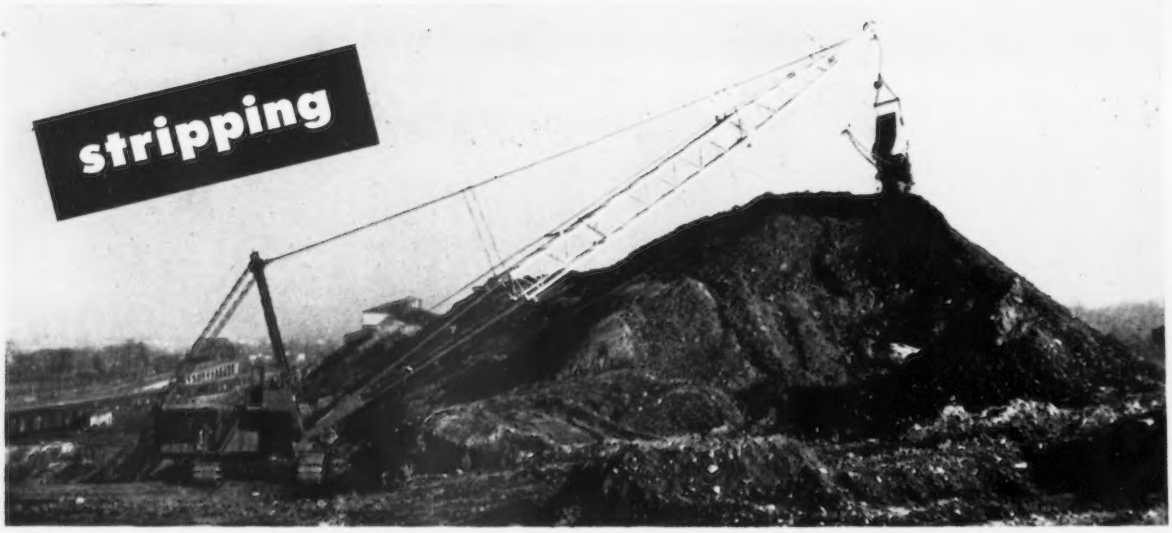
250 TON WRECKING CRANE



COAL-ORE BRIDGE

CAR DUMPER

INDUSTRIAL BROWNHOIST CORPORATION • BAY CITY, MICHIGAN • DISTRICT OFFICES: New York, Philadelphia, Cleveland, San Francisco, Chicago; Montreal, Quebec • AGENCIES: Detroit, Birmingham, Houston, Los Angeles.



The Big Swing is to MANITOWOC

There's a big swing to mighty Manitowocs all through the mining industry — a big replacement trend as more and more operators, after studying costs and production figures, switch to Manitowoc.

You'll find Manitowocs ideally suited to your job too, because they're specially designed for mining. You'll find features no other excavator can match size for size — extra long hi-lift shovel booms for loading and stripping — extra long dragline booms with big bucket capacity for long reach and big yardage — long crawler lengths for maximum stability and flotation — more power on the bucket because of main machinery simplicity — and the exclusive TORQUE CONVERTER DRIVE which adds extra yardage and faster production on every cycle.

Ask the Manitowoc owners in your vicinity — check for yourself — find out why the big swing is to Manitowoc. Manitowoc Engineering Corp., Manitowoc, Wisconsin.

MANITOWOC
SHOVELS 1-5 YD. SpeedCrane CRANES 18-100 TON

HH SINK FLOAT

PROCESS

geared to meet the world demand for

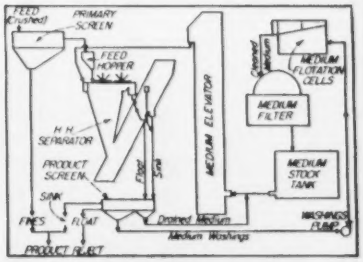
INCREASED ORE PRODUCTION

Even conservative estimates of future demands for metals fall far beyond the capacity of today's mining industry.

The answer is—more efficient processing and equipment. In this connection, the Sink Float Process has fully demonstrated better recovery and less overgrinding for lower capital and operating cost.

By rejecting coarse waste before final grinding, it minimizes the most expensive single step in milling, the "bottleneck" to increased production.

SINK FLOAT



-H. H. SINK FLOAT PROCESS-

PRE-ENGINEERED • PRE-FABRICATED

Recent developments in this widely-used ore separation process, have resulted in increases in metal recoveries, reduced concentration costs, savings in man-hours and increase in metal reserves.

Other advantages realized through the H. H. Sink Float Process include:

. . . ability to make closer separation on difficult feeds
. . . positive control of separation density
. . . positive removal of float product
. . . positive removal of sink product
. . . less power required for operation
. . . ability to treat coarser sizes
. . . easier to start after shut-down
. . . easy to run . . . any mill operator can run it
. . . low first cost per ton treated

Additional features of this process are:
. . . rejects coarse waste without grinding it
. . . produces coarse market concentrate
. . . permits non-selective mining
. . . treats metallics as well as non-metallics
. . . treats mine ores, dumps, fill, development ore
. . . serves existing and new installations

The H. H. Sink Float Plants are pre-engineered and pre-fabricated with economy in time and construction costs.

It will be to your advantage to explore the possibility of the H. H. Sink Float Process. Let us give you the names of plants now operating this process. Write for further information today.

THE SINK AND FLOAT DIVISION
C. TENNANT, SONS & CO., OF NEW YORK
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HERE'S HOW TO . . .

Put the brakes on

U·S·S High Strength Steels cut costs by

1933 UNITED STATES STEEL USS HIGH STRENGTH STEELS 1953

TWENTY YEARS OF PERFORMANCE

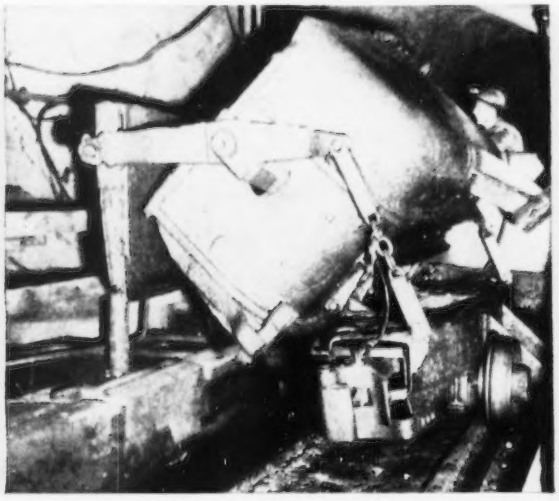
A lot of your money goes into hard-working equipment. Certainly, you have to make that original investment. But when equipment breaks down . . . when parts wear out, it means you have to spend *more* money for replacements, labor and repairs. It also means that you lose output while essential equipment is down.

This is sheer waste! And you can stop it!

It's agreed that premature equipment failures are usually caused by corrosion, abrasion, the effects of shock, often at sub-zero temperatures, constant hard usage and accidents.

But you can get maximum resistance to these destructive forces by using U·S·S High Strength Steels in vital parts. Each of these famous steels was designed to resist certain types of attack. By the use of the right steel, or combinations of these steels to meet your particular con-

THIS 26½ CUBIC YARD dump trailer, built by Trailmobile Co., was made stronger and more resistant to atmospheric corrosion by the use of U·S·S COR-TEN steel. What's more, the use of COR-TEN steel permitted a weight reduction of 1,000 pounds.



IN A WESTERN COPPER MINE, twenty-two 74-cu. ft. mine cars like this, built by C. S. Card Iron Works Company, were put into service eleven years ago. ¼-in. COR-TEN steel was used in body and floor plates. Each car has handled over 85,000 tons of highly abrasive ore. How's that for stamina?

runaway costs!

increasing life and reducing maintenance

ditions, you can give your equipment the stamina it needs to stay on the job.

Take U·S·S Cor-Ten steel, for example. . . . This pioneer high strength steel has a yield point of 50,000 psi, plus 4 to 6 times the resistance to atmospheric corrosion of plain steel.

U·S·S Tri-Ten steel has the same high strength, plus an unusual ability to withstand shock at sub-zero temperatures. What's more, it has good welding qualities and formability.

And U·S·S Man-Ten steel, though it costs slightly less, also has a 50,000 psi yield point, as well as weldability and formability.

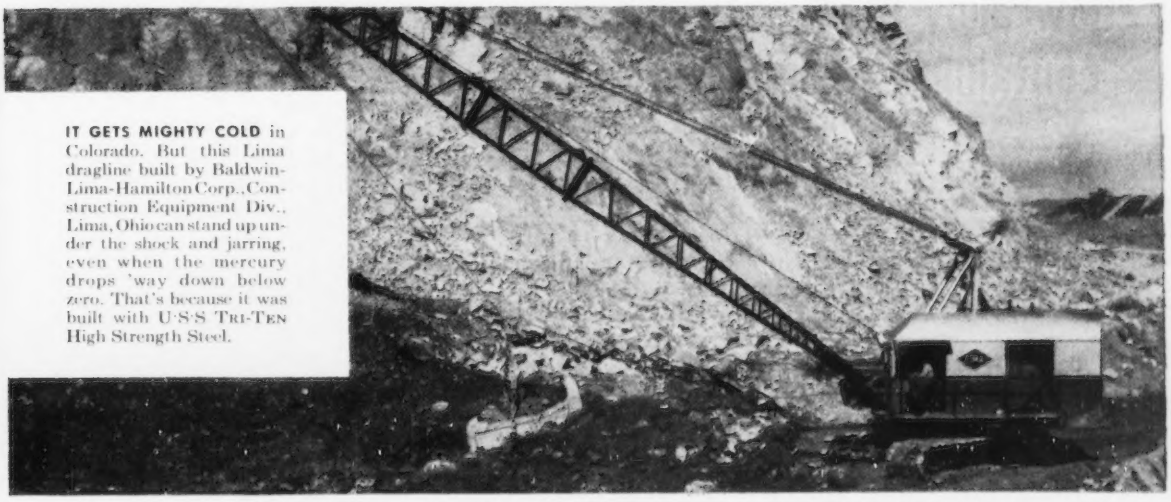
Any of these steels—when used in the same thickness as you'd use ordinary steel—will increase strength up to 50% and greatly increase your equipment's ability to withstand the abuse of today's high speed operations, the jarring and twisting of heavy loads and the damaging effects of sudden impact. Yet, *the weight of that equipment will be no greater than that built of ordinary steel.*

If, on the other hand, you want to *reduce* equipment weight without reducing the strength factors you have now, simply use one of these high strength steels in lighter sections than you'd use plain steel.

Increased equipment strength and/or lighter weight mean longer life . . . less maintenance . . . fewer replacements . . . a substantial reduction in your costs.

Contact our nearest office for complete information. We'll show you exactly where and how these famous steels can be applied in your mine, and point out the savings you can expect.

Call today.



IT GETS MIGHTY COLD in Colorado. But this Lima dragline built by Baldwin-Lima-Hamilton Corp., Construction Equipment Div., Lima, Ohio can stand up under the shock and jarring, even when the mercury drops 'way down below zero. That's because it was built with U·S·S Tri-Ten High Strength Steel.

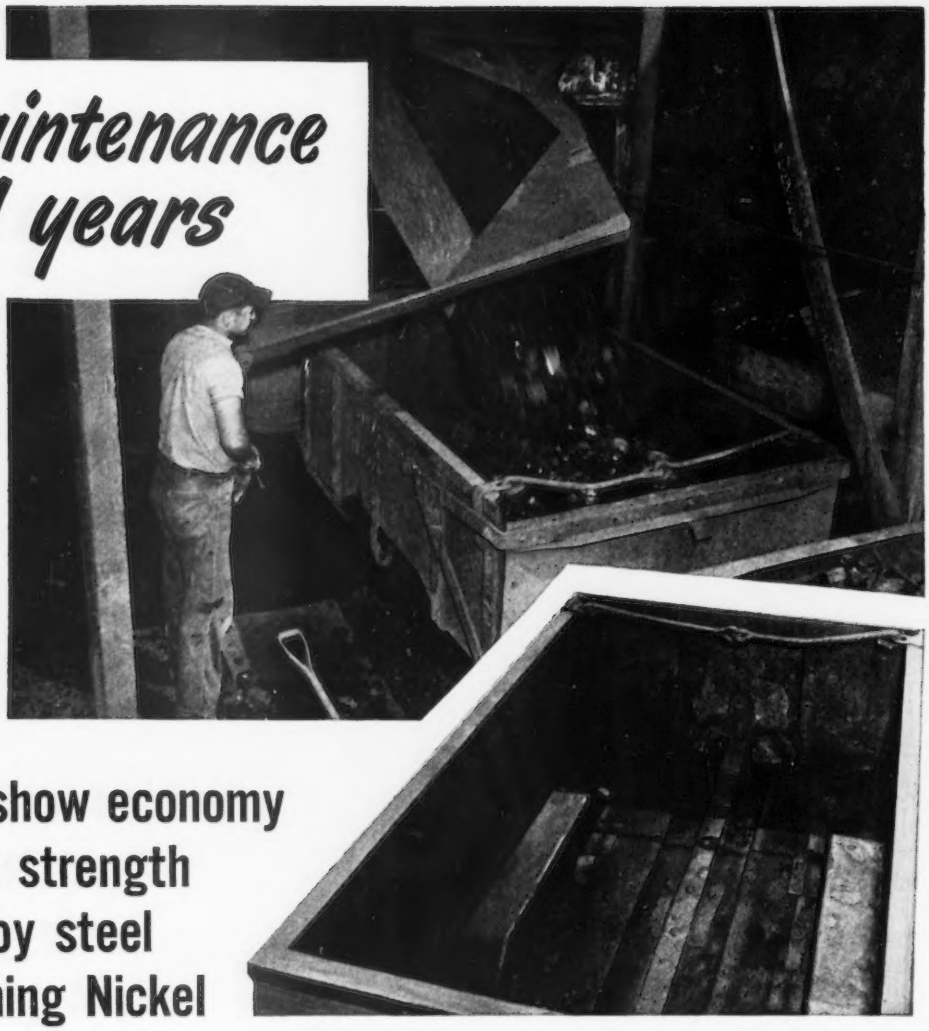
UNITED STATES STEEL CORPORATION, PITTSBURGH · AMERICAN STEEL & WIRE DIVISION, CLEVELAND · COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH · TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. · UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S High Strength Steels

USS TRADE MARK

UNITED STATES STEEL

No Maintenance in 11 years



Mine cars show economy of high strength low alloy steel containing Nickel

Look at these cars after 8 years in deep mine service, then operated for three years in strip mining . . .

Glance at the interior to verify the remarkable 11-year performance of ¼" U·S·S Cor-Ten . . . a high strength low alloy steel containing nickel produced by UNITED STATES STEEL CORPORATION. Despite hard usage, acidulous mine water and other corrosive operating conditions, none of the steel parts of these cars has required maintenance — not even painting.

Why? Because steels like this are stronger and tougher than plain carbon steel...and definitely more resistant to impact, abrasion, wear and corrosion.

Produced under various trade names by leading steel companies, these high strength steels containing nickel along with other alloying elements, provide three basic advantages:

1. Good resistance to corrosion, abrasion and impact.
2. High strength in the as-rolled condition, permitting important weight reductions or improved factors of safety.
3. Excellent response to usual fabrication operations, including easy forming and welding.

At the present time, nickel is available for end uses in defense and defense supporting industries. The remainder of the supply is available for some civilian applications and governmental stockpiling.

INCO

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

Japan *(Continued)*

Starting date: Mar. 1954. The St. Joseph process is employed.

Toho Zinc Co. Project: Zinc oxide plant at Annaka, Gumma prefecture. Investment: $119,000. Capacity: 334 tons of slag per month. Starting date: Sept. 1953. Slag fuming method will produce zinc oxide.

Mitsui Metal Mining Co. Project: Zinc distilling plant expansion at Kamioka, Gifu prefecture. Investment: $25,600. Capacity: 50 tons of slag per month. Starting date: Mar. 1953. Slag fuming method will produce zinc oxide.

Nihon Mining Co. Project: Electrolytic copper plant at Saganoseki, Oita prefecture. Investment: $2,050,000. Capacity: 1,500 tons of ore per month. Starting date: March 1954. Oxygen smelting is employed.

Sumitomo Metal Mining Co. Project: Gold cyanide plant at Konomai, Hokkaido. Investment: $55,500. Capacity: 1,350 tons of ore per month. Starting date: July 1953. Cyanidation process is employed.

Aluminum Power

(Continued from page 124)

materials, outgoing metal.

In the U. S. where it is progressively more difficult to meet these conditions, natural gas and diesel fuel have been utilized. Large smelters are now operating on these power sources but power costs are higher by as much as 2¢ per pound of aluminum over those of plants using hydroelectric power.

A new process developed by the Bureau of Mines shows promise of offering low-cost power. Dry pulverized lignite is roasted in a fluidized bed to drive off the tar. A portion of the material is oxidized to provide heat for the operation and a finely divided char is left which is immediately burned to generate power. If a market can be found for the by-product high molecular acid tar, the cost of power generated will be equal to or only slightly higher than cheap hydroelectric power.

Application of atomic power may solve some of the reduction plant's problems, but although a quiet rumor implied that Alcoa gave up its huge Taiya project in Alaska to await atomic developments, the rumor was denied, and experts in the field do not foresee an aluminum plant running on atomic power within the next 10 years.

A NEW 45 TON RUGGED ROCK HAULER

● Built to take the shock and beating of rock. Carries 29 yards, heaped, or 45 tons. Speeds to 34 mph. Dumps on the go. Right or left discharge. Big target for easy loading. Positive dumping.

THAT'S THE BIG, NEW ATHEY TRAILER! Designed exclusively for use with the Caterpillar DW20 Tractor. See your Athey-Caterpillar Dealer. He'll show you how Athey Trailers are cutting costs and hustling production on job after job.

SEE ALL THE BONUS FEATURES YOU WANT IN YOUR *HIGH-SPEED* HAULER:

- STRONG . . . ALL-WELDED . . . HIGH TENSILE STRENGTH STEEL BODY
- FULL AIR BRAKES FOR FAST, SURE STOPS
- NEW STABILIZING JACKS FOR 6-WHEEL STABILITY DURING DUMPING AND HIGH SPEED HAULING
- EXTRA STRONG YOKE
- ONE-MAN OPERATION
- POSITIVE HYDRAULIC SYSTEM

Athey

ATHEY PRODUCTS CORPORATION

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CHICAGO 38, ILLINOIS

Sure, I want to cut hauling costs . . . tell me how!
☐ Send literature. ☐ Show me color movie.

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Company _____
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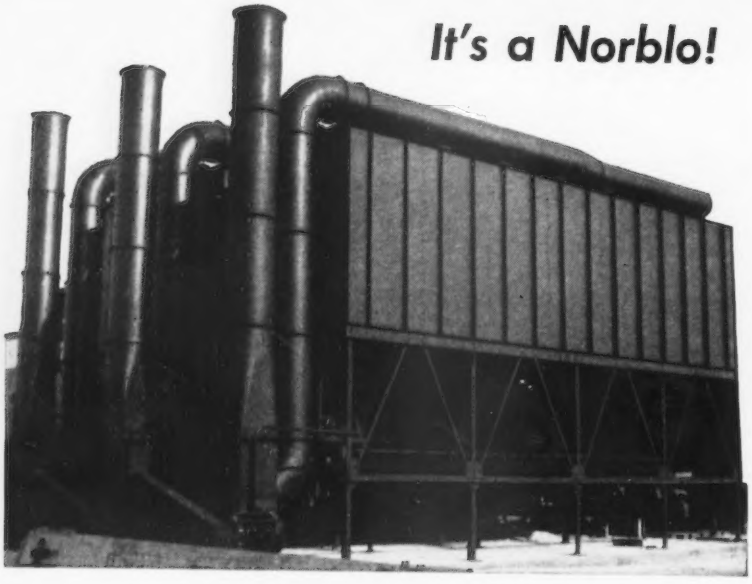
EM7



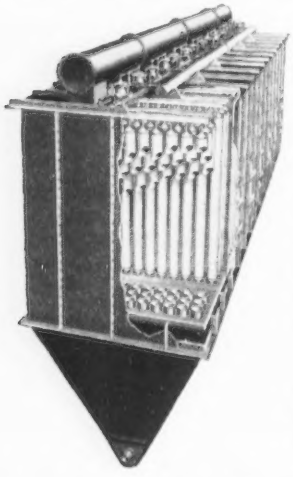
It's a Norblo!

Important dust control jobs from coast to coast use

Norblo

Automatic Bag Type Collection

Of all the major types of dust and fume collection systems, the modern automatic bag type process as developed by Norblo is the most widely useful and adaptable. Its use in important large scale production processes extends from coast to coast, and to foreign lands.



Continuous operation at full rated capacity — handling heavy dust loads by maintaining a constant suction drop across the arrester — is the performance that Norblo Equipment delivers day after day.

There is *no down time* with a Norblo Automatic Bag Type Arrester. Rugged construction, basic unit compartment and few moving parts combined in a fully functional coordinated design insure very high efficiency and low cost of operation and maintenance.

Norblo also builds centrifugal and hydraulic dust collectors, exhaust fans, cement air cooling systems, and portable type dust collectors. Write for literature on any of these.

The Northern Blower Company

Engineered Dust Collection Systems for All Industries

6410 Barberton Ave. OLympic 1-1300 Cleveland 2, Ohio

Small Mines

Continued from page 159

but who share the return on the basis of the tax bracket applicable to the investor.

True, the 1951 Internal Revenue Code provided for expensing of exploration costs to $75,000 in any one year. However, the opinion of several tax experts is to the effect that individual investment in exploration projects cannot be so expensed. Thus, the "grubstaking" method of financing, which has long played so prominent a part in exploration, has been denied the very incentive that this tax revision was designed to provide. To rejuvenate prospecting, the individual investor should be allowed to expense an investment in a bona fide exploration project entirely against any personal income.

The combination of depletion and depreciation allowances and rate of tax on profits makes accumulation of reserves for expansion of small mine plants and ore reserves difficult even when profits are being realized. They tend to freeze the mine at its present level, to force liquidation of its present ore reserves. Often where there are profits, the residue after taxation is inadequate to give the stockholder some return on his investment and to finance expansion. Understandably, the stockholder, in many cases, gets first preference; consequently, expansion possibilities are neglected and ore reserves liquidated.

Present tax policies rather obviously are designed to get the maximum income from known ore reserves with little regard for perpetuation or expansion of the industry. The policy is strictly of the "kill the goose that laid the golden egg" variety.

This is recognized even by the Paley Commission staff. "Even" is used advisedly for many conclusions presented by that report would be, if carried out, harmful to the domestic mining industry and to the welfare of the country. They comment and recommend as follows on expensing of exploration costs (p. 35-Vol. 1):

"The privilege of expensing exploration and development costs for minerals is a further inducement to risk capital to enter fields where a broadening of national reserves is needed."

"The Commission, therefore, recommends:

"That the present limitations ap-

(Continued on page 312)

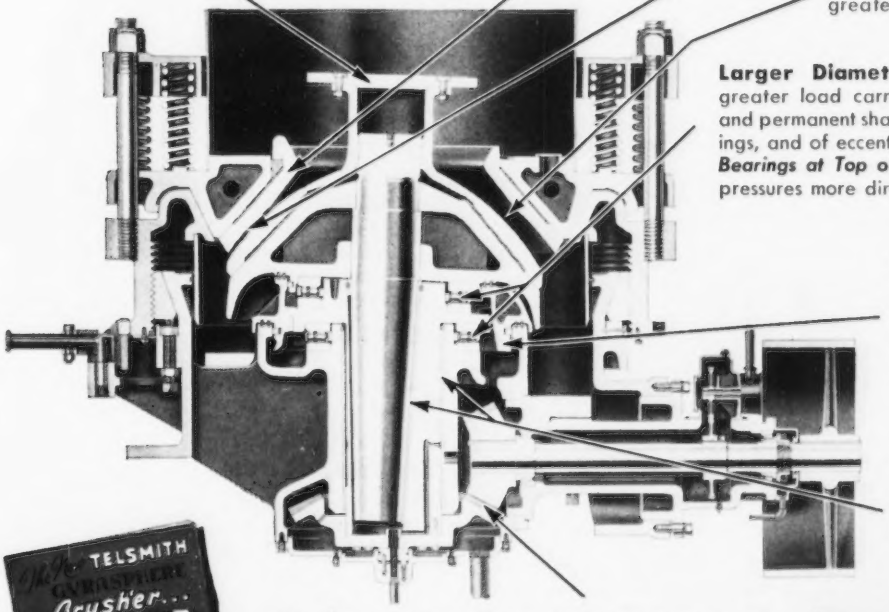
Outstanding FEATURES OF THE TELSMITH® *Gyrasphere*®

Feed Distributor gives an even distribution of the feed around the entire feed opening, resulting in a more uniform crushed product.

Gun-Lock for Holding Concave Ring — Automatic self-tightening, requires no bolts, and is easier to change.

Longer Parallel Crushing Zone gives a finer, more uniform product with a larger percentage down to size.

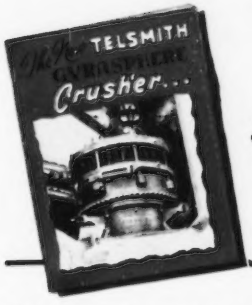
Longer Crushing Stroke gives greater capacity and less packing.



Larger Diameter Roller Bearings with greater load carrying capacity. Give perfect and permanent shaft alignment in eccentric bearings, and of eccentric in main frame. ***Both Roller Bearings at Top of Eccentric*** carry all crushing pressures more directly into heavy main frame.

Patented Rotary Seal with piston ring and labyrinth seals, gives most perfect protection against entrance of dust or water, or loss of lubricant.

Higher Eccentric Bearings give more bearing area in the upper zone of greatest crushing pressures, assuring more permanent shaft and eccentric alignment and longer bearing life.



Send for Bulletin No. 274

Main Drive Gear At Bottom of Eccentric assures more perfect and permanent alignment of gear and pinion, giving smoother running and longer life for both gear and pinion and less strain on countershaft bearings.

Y-12

STYLE FC
FINE CRUSHING

SMITH ENGINEERING WORKS, 502 E. CAPITOL DRIVE, MILWAUKEE 12, WISCONSIN

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there's a *BIG* difference ...in this 3/4 yd. shovel!

Look beyond the dipper size when you investigate your next 3/4-yard shovel. Shovels may be rated the same, may even look alike, but that's where it ends when you look at a Lorain TL-25.

Look into the cab to see if power flows directly and efficiently from the engine to the point of use, as it does on the "TL-25".

Look to see if it has a great quantity of duplicate and interchangeable parts . . . does it have "packaged components" to permit quick switching of all major components. The "TL-25" has them.

Look at what these "TL-25" features mean on the job. If you believe *actions speak louder than words,* you'll like the "TL-25" because it really shines on field performance. We'd be glad to show you the proof of these statements.

THE THEW SHOVEL CO., LORAIN, OHIO

3/4 yards of power *plus* . . .
Whether gas or diesel, it goes to work directly . . . tears into the job . . . and turns out profit-earning yardage.

3/4 yards of speed *plus* . . .
You can capitalize on every bit of "TL-25" power because in operation it responds with lightning speed, has high acceleration that kills "drag", and is a muscle-saver for the operator.

3/4 yards of endurance *plus* . . .
Anti-friction bearings, oil-enclosed gears, 5 identical shoe clutches, drop-forged hook rollers . . . and other items of highest quality materials and workmanship assure "TL-25" stick-to-it-iveness on the job.

3/4 yards of selection *plus* . . .
No other machine in *any* class offers such a selection of booms and mountings to hit your job right-on-the-button. Select from 4 crawler sizes, 7 rubber-tire mountings, 7 interchangeable booms.

THEW LORAIN®

TL 25

SHOVELS • CRANES • DRAGLINES • CLAMSHELLS • HOES

PUMPS

for FLUID POWER

To perform a hundred and one functions in deep or strip mining . . . pulling, pushing, lifting, lowering, spinning, twisting . . . providing controlled power as only hydraulic power can deliver it. Here is a range of Pump types, capacities and pressures 0 to 1,500, 2,000 and 3,000 psi. Here, too, are motors, valves and cylinders to be integrated into complete hydraulic circuits which translate power into efficient, economical, trouble-free accomplishment.

for HANDLING LIQUIDS

An exceptionally broad range of types, sizes, and special constructions to handle virtually "any substance that will flow through a pipe" . . . deep and shallow well Centrifugal and Turbine Pumps . . . Rotating Plunger and Herringbone Gear Pumps with capacities from 3 to 7,500 gpm.

for VACUUM PROCESSING

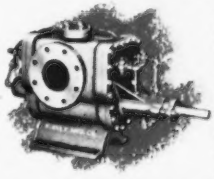
in pump sizes for the laboratory or high production. Extensively used in research, dehydration, refrigeration, vacuum drying, vacuum refining of metals, electronic and atomic research.

HYDRECO GEAR TYPE PUMPS

Reversible and non-reversible. Gear type pumps in exclusive FOUR-BOLT design . . . capacities from .5 to 130 gpm and operating pressures to 1500 psi . . . flange or foot mounted . . . furnished with keyed shaft with spline shafts optional. Also dual and tandem models.

KINNEY LIQUID HANDLING PUMPS

A complete range of sizes in Rotating Plunger and Herringbone Gear Pumps to handle light or heavy liquids, sludges, slurries or viscous substances. Available in plain or steam jacketed models and built of special corrosion resistant metals where desired.

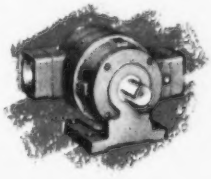


KINNEY VACUUM PUMPS

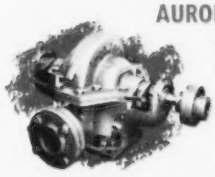
Single stage models to produce absolute pressure readings of 10 microns (.01 mm Hg.) . . . compound pumps producing readings of .2 microns (.0002 mm Hg.) or better. These Kinney High Vacuum Pumps are available in sizes for laboratory as well as high production use.

DUDCO DUAL VANE TYPE PUMPS

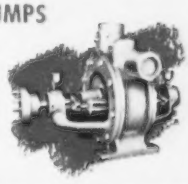
DUDCO Pumps provide a broad range of sizes with capacities to 120 gpm and pressures to 2000 psi. Also available in multiple units operating from a single drive. Hydraulic motors with starting torque outputs to 14,000 lb. in. at 2000 psi.



AURORA CENTRIFUGAL & TURBINE PUMPS

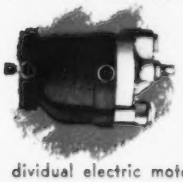


Deep well, sump, drainage and condensation return units, household water systems. Industrial low and high pressure liquid handling pumps. Direct motor and countershaft driven horizontal and vertical models. Capacities 3 to 7500 gpm.



STRATOPOWER PISTON TYPE PUMPS

Axial reciprocating piston type . . . constant or variable delivery with capacities of .25 to 10 gpm at nominal speeds of 1500 rpm with maximum of 4500 rpm . . . working pressures to 3000 psi . . . direct engine and individual electric motor driven models.



Write—

For detailed information on the type of pump in which you are interested.

THE NEW YORK AIR BRAKE COMPANY

230 PARK AVENUE • NEW YORK 17, N.Y.

THE NEW YORK AIR BRAKE COMPANY
230 Park Avenue, Dept. EM, New York 17, N. Y.

Gentlemen: Kindly send additional information on the pumps I have checked.

- ☐ Hydreco Pumps
- ☐ Stratopower Pumps
- ☐ Dudco Pumps
- ☐ Kinney Liquid Handling Pumps
- ☐ Kinney Vacuum Pumps
- ☐ Aurora Pumps

Name .....

Address .....

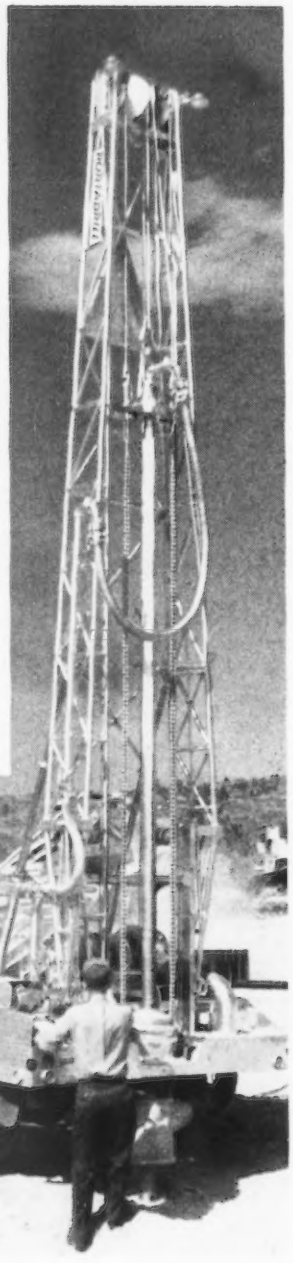
City ..... State .....

REDUCE DRILLING COSTS

in **EXPLORATION**
DEVELOPMENT
PRODUCTION

with the
UNITIZED BHD "AIR BLAST"

PORTADRILL
REG. U.S. PAT. OFF.



- Drilling speeds of a foot or more per minute; accurate sampling and formation testing; faster vertical blast holes for development and production are possible with the BHD "Air Blast" Portadrill.
- Portadrill cuts costs by utilizing a single truck-mounted rig and a two man crew. It has greater mobility, "sets-up" faster, drills faster, moves out faster. Efficient air compressor keeps hole bottom clean, prolongs bit life.
- Simplified construction, standard parts, ease of servicing—all contribute in making the "BHD" the ideal cost-cutting drilling equipment.

Portadrill models include compressed air, conventional and Reverse Circulation drills with depth capacities to 2,000 feet and hole diameters to 60". Complete information, price and delivery date available on request.

PORTADRILL
REG. U.S. PAT. OFF.

Manufactured by the Winter-Weiss Co.

2201 BLAKE STREET **DENVER, COLORADO**
Eastern Dist.: Walter H. Duncan Co., 5536 Penn. Ave., Pittsburgh, Pa.

Small Mines *(Continued)*

plicable to minerals other than oil and gas on the amount of permitted expensing of exploration costs be removed."

Amen—only let's extend it to cover the individual investor!

Canada and Mexico both recognize the need of incentives for mineral exploration. Canada allows three years free of taxes after a property comes into production, and Mexico materially reduces tax liability for certain periods for new or rejuvenated mines.

In mining's early history, communities grew up around the locale of mining activity. The community was a part of the mining enterprise, and its activities were geared to the mine or mines in its area. Mine managers often carried the dual responsibilitiy of community and mine management.

That situation has changed. The mine is now most usually but a part of a community of complex activities and interests. Both large mining and small have, in their absorption in the mechanics of mining, been engulfed in the new environment without sufficient adjustment to it, often without conscious recognition of the trend. The challenge of the greater responsibility of complex associations has not been met.

The general result has been the removal or diminishing of incentives, needless restrictions on mining activities, and the threatened loss of some of mining's basic rights. The net result threatens both large and small mining. The broad solution is for all of mining, both large and small, to determine the ills and fight vigorously for the cures.

We have gone a long way on the matter of determining the ills. Many mining organizations meet regularly to discuss such matters, issue declarations of policy, and make recommendations. Carried only to that point, such activities are a bit like a family reunion, they all agree on the fine family characteristics, but such agreement has little effect on their individual relationships with their individual neighbors. We have not, in agreeing among ourselves, sold the basic importance of mining to either the local or national community.

Utah's Governor J. Bracken Lee recently told a group of mining men with whom he was discussing problems of mining, that he often wondered why mining people, having

(Continued on page 314)

Jones & Laughlin

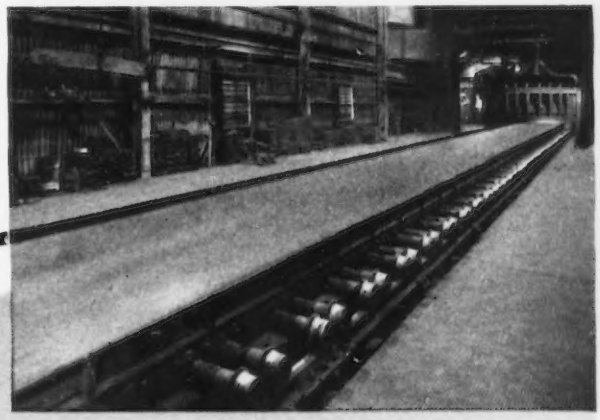
SINTERS MARTITE FOR OPEN HEARTH AND BLAST FURNACES WITH THE NEW

DWIGHT-LLOYD® Sintering machine

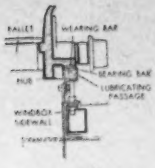
Jones & Laughlin, in their new plant at Star Lake, N. Y., achieves maximum flexibility in sintering martite with the new DWIGHT-LLOYD® Sintering machine. Because of the superior quality of the sintered martite it can be used in open hearth furnaces in place of scrap as well as for blast furnace operation.

This new model DWIGHT-LLOYD® sintering machine is designed to give maximum output along with high quality product. It is the largest ever made for iron ore operation, in size and in capacity, producing approximately 1600 tons of sinter per day. It measures 6′ 6¾″ wide by 147′ long.

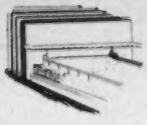
Whether it is sintering martite or sintering, roasting, heat treating and agglomerating a wide variety of other ores and metals, the new Dwight-Lloyd® machine can give you increased production at lowered costs.



features of the NEW Dwight-Lloyd® Sintering Machine

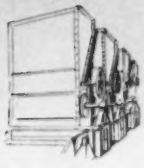


ROWEN WINDBOX SEAL* completely eliminates air leakage between pallets and windbox, with these results: *a more uniform product* – material at edges gets same amount of air as it does in the center; *greater production* – more efficient burning permits faster operation; *lower operating costs*– a smaller air volume is needed.



COOLING SECTION-material is cooled while it is on the pallets, resulting in a better sinter and also facilitating handling and further processing.

DISCHARGE CURVE*– compound curve virtually eliminates spillage of sintered fines into the machine.



ROLL FEEDERS assure even distribution of charge as it is fed on to the pallets. Quiet and non-clogging operation.

UTILIZATION OF HOT GASES-if desired hot gases can be recirculated over the sinter bed resulting in the use of less fuel in the charge and lower plant heating cost in winter.

Pilot Plant Tests Your Materials. A pilot sintering plant is maintained for testing your materials under production line conditions. In this way we can establish your optimum sintering requirements. Write today for further details.

*PATENTED

METALLURGICAL DIVISION

SINTERING MACHINERY CORPORATION

120 SINTER AVE. • NETCONG, N. J.

Designed for the Environment...the Hippopotamus and the SKOOKUM slusher block

Not a thing of beauty, but almost perfectly executed for its habitat is the Hippopotamus. At home in swamps and rivers...yet able to travel at amazing speed on land, the Hippo, with a 1½" hide, can cope with any hazard but a missile in the brain. He is a good example of perfect design for a hazardous environment ...as is the SKOOKUM SLUSHER BLOCK...a block carefully made to operate flawlessly in dust, muck, mud or under water. Its Timken roller bearings are protected by a patented grease seal. Broad throat passes knots. Manganese sheave is virtually non-wearing. No wonder Skookum is preferred by the majority of mine operators. **WE BUILD TO YOUR SPECIFICATIONS.**

THE SKOOKUM COMPANY, INC.
8504 N. CRAWFORD ST. PORTLAND 3, OREGON

Small Mines *(Continued)*

such serious problems, did so little fighting for their cause. He recited a number of cases in his experience in which other groups having less reason for corrective action had staged much more intensive campaigns. He advised the miners to determine first that their cause was right and then to fight for it with all possible intelligence and energy.

There are problems other than wide price fluctuations and taxes which require serious attention and vigorous action.

The mining laws are threatened by the philosophy of Federal ownership of the public domain. Realization of such purposes would be counter to the objectives and purposes of the mining law as clearly expressed in a recommendation of one mining group:

"The objective of the mining laws was the opening of public lands to private enterprise for the development of the nation's vast mineral resources. The intent of Congress was to provide an orderly procedure for vesting title in private ownership in return for enterprise and initiative in discovering minerals in the public domain, with the land eventually being placed on state tax rolls."

The mining industry and related communities should solidly and vigorously urge a policy of full administration of the present law, for most of the abuses claimed would be corrected thereby.

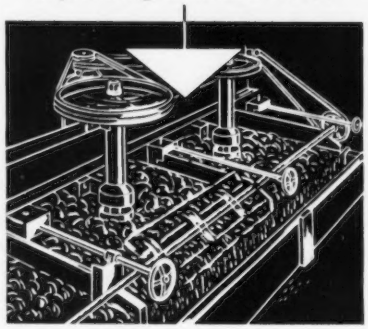
Another problem of all segments of mining is increased costs in face of lagging productivity. The solution encompasses a large field of study and effort, including technology of equipment and its use, treatment processes and costs, transportation costs, research directed toward increased use of the metals, labor-management relations, and common understanding of productivity in relation of standard of living.

Regular government functions in relation to the mining industry have been centered largely in the administrative bureaus. Excellent service has been rendered by those bureaus and by individuals in bureaus who followed their intended role as administrators of the law, and did not by encroachment or propaganda try to go beyond it. We should continue to support them in their capacities as administrative servants.

In conclusion, it is pertinent to restate the thought that the prob-

(Continued on page 316)

Separating Oxidized Ores?



PQ® Silicates can be the answer to higher recovery. As a flotation agent for valuable minerals in complex separations, the right silicate is effective in depressing siliceous gangue slimes.

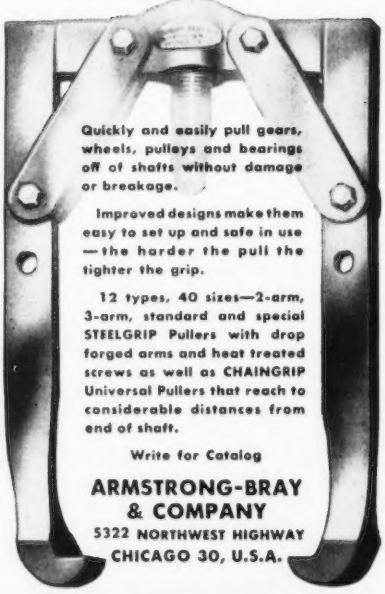
For some operations, PQ® Silicate may be used in reverse flotation.

Write us about your problem.

PHILADELPHIA QUARTZ COMPANY
1135 Public Ledger Bldg.
Philadelphia 6, Pa.

PQ® Silicates of Soda
METSO DETERGENTS

ARMSTRONG-BRAY
GEAR and WHEEL PULLERS



Quickly and easily pull gears, wheels, pulleys and bearings off of shafts without damage or breakage.

Improved designs make them easy to set up and safe in use —the harder the pull the tighter the grip.

12 types, 40 sizes—2-arm, 3-arm, standard and special STEELGRIP Pullers with drop forged arms and heat treated screws as well as CHAINGRIP Universal Pullers that reach to considerable distances from end of shaft.

Write for Catalog

ARMSTRONG-BRAY & COMPANY
5322 NORTHWEST HIGHWAY
CHICAGO 30, U.S.A.

A NEW ONE-MAN DRILLING MACHINE

with integral air-leg feed and automatic air-water back-head

Perfected by Thor

No. 380 AUTOMATIC DRILLING MACHINE

With Aluminum Cylinder and Piston

TOTAL WEIGHT 80 LBS.
36" OR 48" FEED

INTEGRAL AIR FEED eliminates improvised clamping, extra air hose; consolidates drilling and feed controls on back-head of machine. Easier to set up, easier to adjust, easier to run.

AUTOMATIC AIR-WATER BACK-HEAD controls water and air from single throttle. Optional plugs for dry collaring, or dry drilling. Provides complete versatility for all drilling conditions.

Check these Thor features!

1. CONTROLS conveniently grouped on back-head for safe, convenient operation.
2. EXCLUSIVE SIX POSITION THROTTLE VALVE . . . from complete shut-off of air and water, to full air and water in logical steps for full control and convenience.
3. AIR LEG CONTROL KNOB conveniently located for natural, right-hand operation. Exclusive instantaneous push-button release for safety.
4. SINGLE AIR HOSE supplies air to drill and to leg (through drill and mounting swivel).
5. PERFECT BALANCE of drill and leg eliminates superfluous adjustments.
6. HINGE JOINT between drill and leg has tension adjustment. Exclusive extra-large friction disc holds selected tension indefinitely.
7. CONSTANT BLOWING ACTION cleans holes of cuttings, keeps cuttings out of chuck and drill.
8. FOR USE AS SINKER, air leg can be easily detached by loosening one nut.
9. WATER AND AIR HOSE swing freely at left, out of operator's way. Exclusive fastening method eliminates possibility of connections loosening or leaking.
10. EXCLUSIVE 2¼" DIAMETER FEED LEG provides added pressure to keep bit on face for longer life, especially when tungsten carbide bits are used.
11. EXCLUSIVE NEW HOLDING HANDLE provides greater safety. Conventional spade handle optional.
12. EXCLUSIVE SCRAPER RING on piston rod prevents solids from entering cylinder. "O" ring seal repels liquids.

For Complete Details or Demonstration Write

Thor PORTABLE POWER TOOLS

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Export Division, 330 W. 42nd St., New York 36, N. Y., U. S. A.
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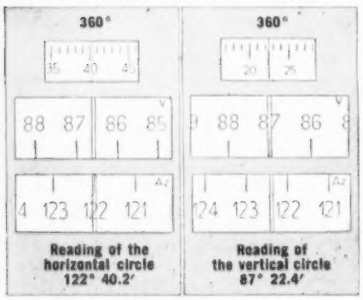
WILD T-1
OPTICAL *REPEATING* TRANSIT Rugged, compact design ... with 20 years of proven service under tough field conditions.

Both circles read from one single station through microscope alongside telescope eyepiece. Optical micrometer eliminates possibility of reading error. Illumination is provided by daylight mirror or by battery attachment for night, underground or mine work.



WILD surveying instruments, inherently accurate, are Swiss precision designed for stability under adverse conditions, for sturdiness, and for ease in operation... they provide lasting trouble-free service.

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Extensive repair and servicing facilities by factory trained specialists.

HENRY WILD
SURVEYING INSTRUMENTS SUPPLY CO.
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POrt Washington 7-4843

Small Mines *(Continued)*

lems of mining are common to all segments of the mining industry; that prospecting and small mines are vital to the continued life of the industry; that all mining individuals and groups should seek the understanding and support of their communities; and that all must join in seeking equitable solutions. To do otherwise would be to place the mining industry in the position of Roman gladiators, who on entering the arena paraded to Caesar's box and declared:

"We who are about to die salute you."

Titanium

(Continued from page 145)

Where is research heading? The answer can only be sketchy for obvious reasons, but here are some hints based on the Paley Report, and opinions of researchers:

1. **Kroll Process.** Best current batch process. Will have to be revamped to a continuous process to survive. Battelle Memorial, U. S. Bureau of Mines and others are reported to be working on this.

2. **The deBoer Process:** Involves the electrothermal production of high-purity metal from impure titanium and iodine by a batch process. This method has a chance if cheaper crude titanium can be produced, and/or if the process can be made continuous or semi-continuous. Research is aiming at this objective.

3. **Electrolytic Process.** Here titanium is recovered from a fused halide of Na, K, or Mg. Holds promise. However the product tends to be oxide contaminated, so research must evolve a method of producing sizable crystals or pellets of oxide-free titanium. Progress is being made along these lines, but some factors say that unless some entirely new technique, hitherto untried, is discovered the electrolytic method will not prove economical.

Unless some bright metallurgist comes up with an entirely revolutionary process, differing from those above, the titanium industry is going to be a power hog (same as aluminum). Estimates for the Kroll process run about 15 to 20 kwh per lb., with research efforts aimed at the lower figure. Translated into production running into hundreds of thousands of tons of metal per year, power consumption will run into billions of kwh per year.

We're going to remodel our old conveyor... who do you recommend for parts?

Barber-Greene is your best bet for all conveyor components, carriers, belts, truss or channel sections, drives, back stops, feeders, etc.

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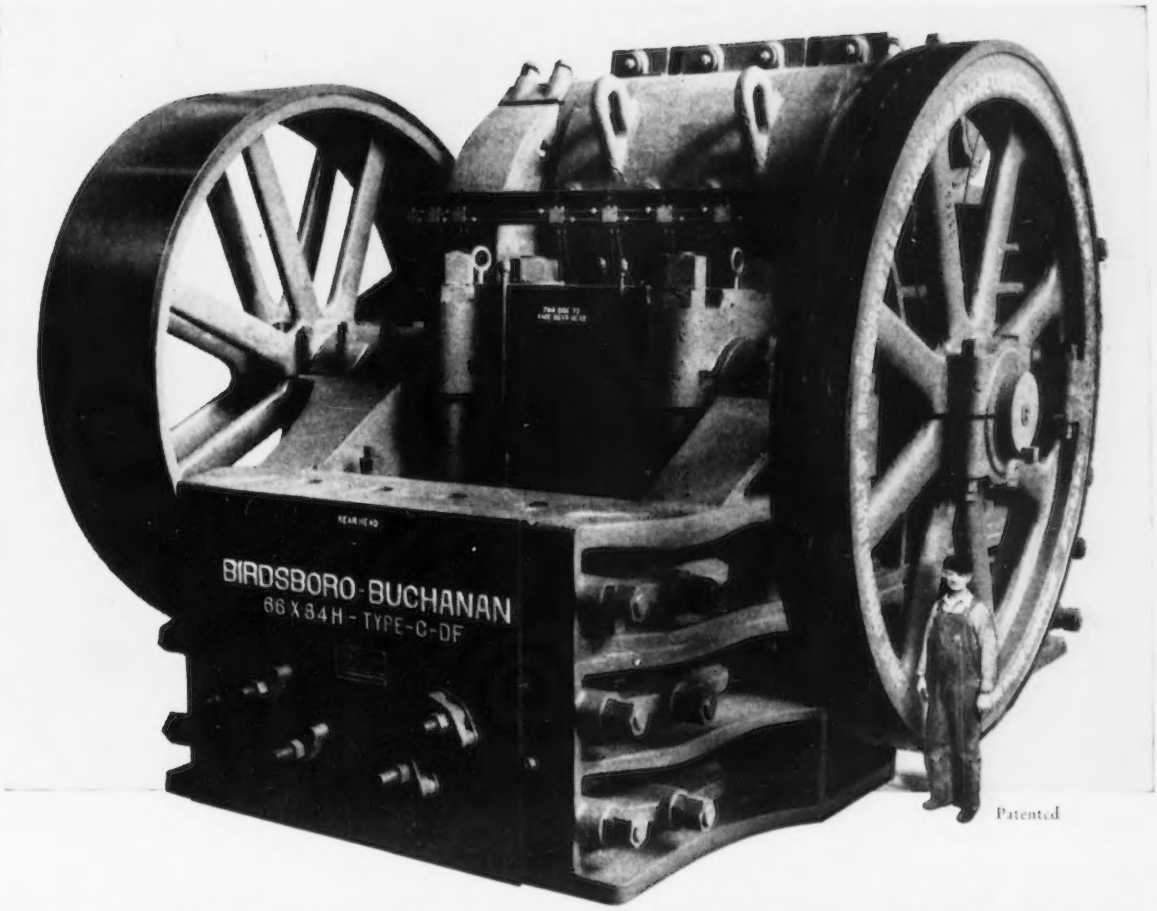

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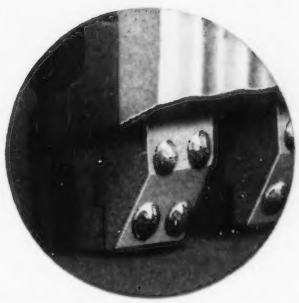
THE LARGEST DEEP FRAME CRUSHER EVER BUILT



OFFSET TOE LUGS THAT NEVER WEAR OFF—

a patented Birdsboro development and standard equipment on all Birdsboro deep frame crushers. They are offset from the face of the jaw plate and allow 50% or more useful plate life.

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One of the largest crushing jobs ever attempted with a jaw crusher has been solved with this giant BIRDSBORO - BUCHANAN 66" x 84" deep frame jaw crusher. With this large receiving opening this crusher will take the feed from a 5 cubic yard shovel crushing the material down to 10" to 12" product at the rate of approximately 1,200 tons per hour. Immense power, high strength and long life have been built into this crusher to provide continuous and dependable crushing service. When you have a crushing problem, regardless of the size of your operation, it will be to your economical advantage to call in Birdsboro engineers.

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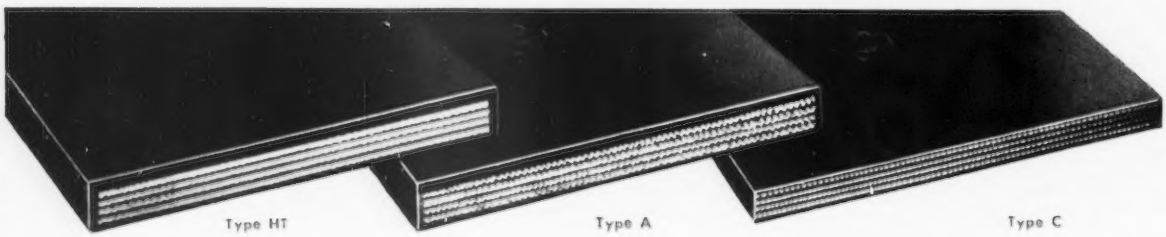
Thermoid can cut your handling cost per ton

Regardless of the weight, abrasive action or temperature of the materials you handle, there's a Thermoid Conveyor Belt that will stay on the job longer, reducing your handling cost per ton.

Thermoid Conveyor Belting for mining, quarrying or heavy construction work is designed for maximum service in these specific uses. Strong cotton fabrics, thoroughly impregnated with high test rubber friction, are combined with tough, wear-resistant rubber covers. Welded together under extremely high pressures to assure exceptionally strong, durable belting.

Your Thermoid Distributor can help you select the belt best suited to your needs. If your problem is unusual, he'll call an experienced Thermoid Sales Engineer.

Thermoid Belting specifically designed for mine, quarry and construction work:



For highly abrasive granite, flint rock, quartz ore, etc.

For slag, lime rock, crushed stone and hot material.

For sand, gravel, loam and finished cement.

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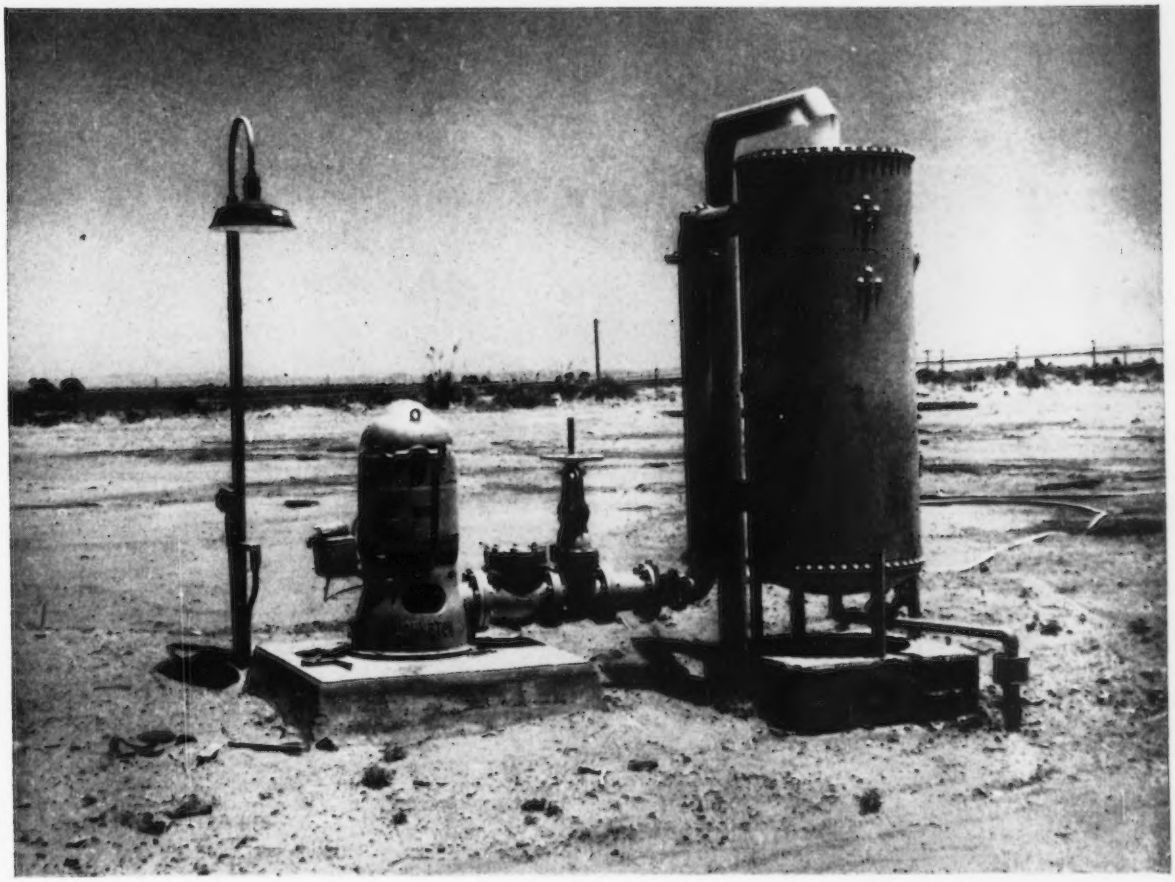
Critical Jobs Are Routine For Johnston Pumps!



...TAKE THIS FLOATATION MILL JOB, FOR EXAMPLE:

Located outdoors on the steaming hot desert near Hanover, New Mexico, two Johnston Turbine Pumps supply water from deep wells for plant operations, sanitation and human consumption at a 400 ton floatation mill.

In selecting the pumps for this job there were 3 primary conditions: first, the units had to be field-proven for high sustained efficiencies; second, shut-down time for maintenance had to be cut to the bone; third, controls had to be located a considerable distance from the pumps.

Johnston not only met all these requirements, but surpassed them!!!

Here are the specifications for the 2 units supplied: 30 H.P., 6 stage, vitriform enameled bowls, bronze closed impellers, oil lubricated column, 300 G.P.M. capacity against a 260 foot head.

This is just another example of the ability of Johnston equipment to handle all kinds of pumping jobs. For the kind of pump "know-how" that puts money in the bank, see your Johnston Dealer, or ask a factory representative to call. They're always glad to help.

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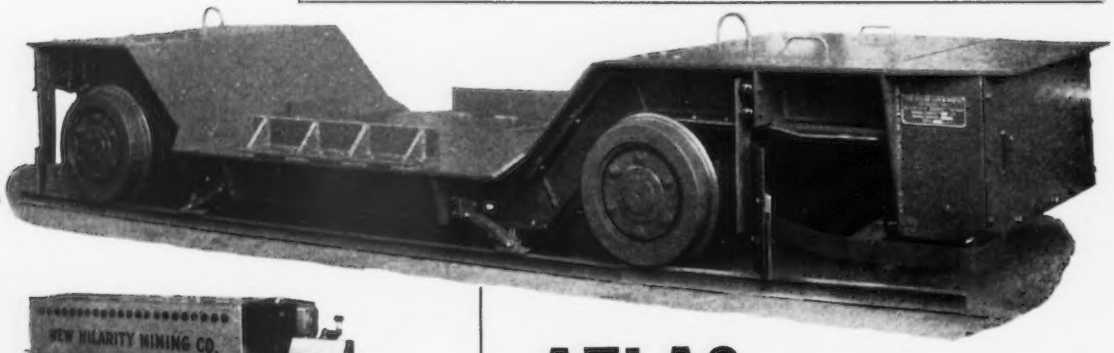
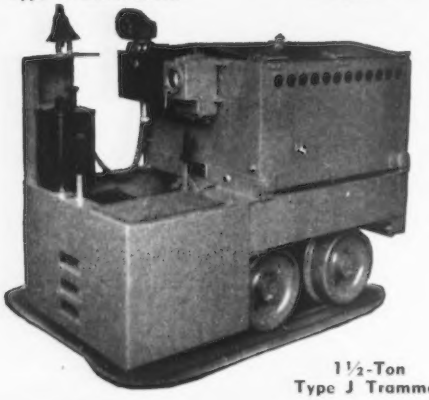
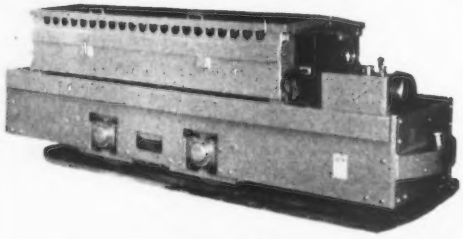
FOR DEPENDABLE LOW-COST HAULAGE



3-Ton
Type K Locomotive



1½-Ton
Type J Trammer



ATLAS Type A Locomotive

ATLAS *SELF-PROPELLED* CARS and LOCOMOTIVES

The ATLAS remote controlled, 64-ton Slag Ladle Electric Car above is operated by means of power fed through insulated track rails. The wheels on one rail are insulated and current is picked up by collector shoes. Controller and resistors are located at a remote station.

ATLAS Storage Battery Locomotives give top performance under the most severe operating conditions. They cost less to own . . . less to operate . . . and less to service.

ATLAS Trammers, like all ATLAS Locomotives, are of simple design—easy to operate—easy to service—and cost less to operate.

We will gladly show you how you can benefit by owning ATLAS Locomotives.

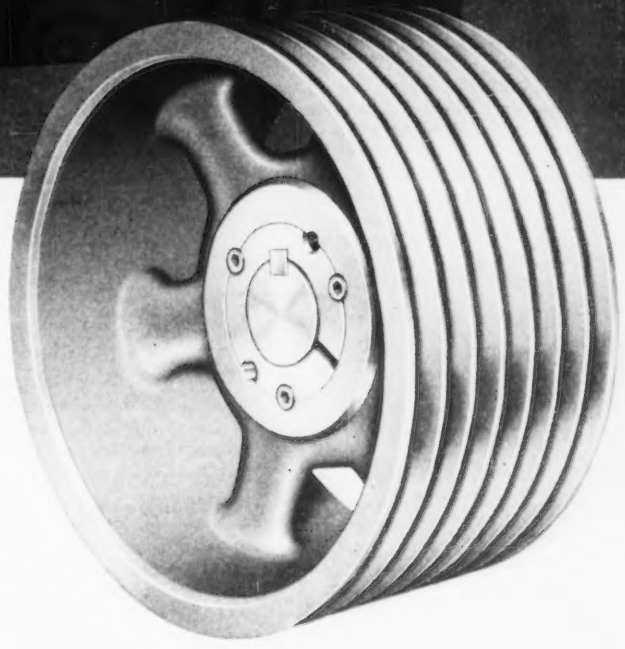
SOLD IN CANADA BY Mine Equipment Co., Kirkland Lake, Ont. — International Agents & Machinery Co., Ltd., Vancouver, B.C. — Universal Mechanisation Company (Pty), Ltd., Johannesburg, South Africa.

THE ATLAS CAR & MFG. CO.

ENGINEERS MANUFACTURERS

1140 IVANHOE RD. CLEVELAND 10, OHIO, U. S. A.

There's only ONE TAPER-LOCK



TAPER-LOCK sheaves run true! The patented Taper-Lock bushing grips the shaft for the full length of the bushing—holds with the firmness of a shrunk-on fit!

Every belt pulls its full share of the load. Grooves, machined on precision equipment, have identical pitch diameters, assuring equal belt tension.

Easy on—Easy off. Slip it on the shaft, line it up and tighten while sighting. In ease and speed of mounting and demounting you'll appreciate there is only ONE Taper-Lock.

No flange, no collar, no protruding parts. Flush hub means safety.

Taper-Lock sheaves are available from distributors' stocks in complete range of sizes in A, B, C and D grooves.

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3100 UNION STREET, MISHAWAKA, INDIANA

1878 DODGE 1953 75th ANNIVERSARY

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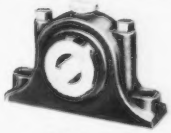
CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory-trained by Dodge, he can give you valuable assistance on new, cost-saving methods. Look for his name under "Power Transmission Machinery" in your classified telephone book.



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ROLLING GRIP AND DIAMOND D FRICTION CLUTCHES

"pH at your fingertips..."

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This revolutionary ANALYTICAL pH PROBE UNIT makes possible on-the-spot pH readings *anywhere*. No more trips to the laboratory, no supports, beakers holders or separate electrodes.

This PROBE UNIT has made possible a true pocket sized pH METER that simplifies pH determination and eliminates errors due to sampling techniques, turbidity, and presence of oxidizing or reducing agents.

No indicating solutions, measurement of sample or color matching are necessary.

Completely self-contained in water-proof ever-ready case with shoulder strap.

PRICE $125.00

Instrument size: 3x5-7/8 x 2-1/2 inches
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Weight with accessories: 3 lbs.

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Personal News

(Continued from page 170)

spor Co. in Hardin County, Ill. from 1932 until last August when the properties were sold to Minerva Oil Co. **Dodd Gibson, Jr.** is now residing in Tucson, Ariz. He plans to return to the non-metallic field in a consulting capacity after October 1953.

Mike Miller has been placed in charge of all activities connected with joint-venture work in which Kaiser Engineers Division of Henry J. Kaiser Co. is interested. A vice president of the company, Mr. Miller was formerly vice president and executive assistant to Edgar F. Kaiser, president of Kaiser-Frazer Corp.

Philip M. Ginder has been elected a vice president and **George F. Halfacre** has been named manager of manufacturing of the New Jersey Zinc Co. (of Pa.). Mr. Ginder has been with that company since 1911. Mr. Halfacre, who has also been at the Palmerton, Pa. plant started his career with the company in 1918.

E. L. Beutner, resident geologist for the Michigan Ore Division of the Jones & Laughlin Steel Corp., has been promoted to be assistant chief geologist, at Pittsburgh. **G. A. Hoffman,** geologist at the Tracy mine, succeeds him.

Lee M. Yarberry has resigned as superintendent of mines and quarries with Coplay Cement Mfg. Co., Coplay, Pa., to take over the modernization and direction of the Sugar Creek mine of the Missouri Portland Cement Co. at Independence, Mo.

Peter M. Mosier, formerly manager of several Montana mining properties, is now making his headquarters at Cortez, Colo.

Richard T. Mecredy, formerly foreman in one of the Butte mines, has been appointed state inspector of quartz mines by the Montana Industrial Accident Board, to succeed **Tom Haney,** resigned.

John E. Kelly, of Washington, D. C., heads Kerr & Co.'s new African service, which includes examination, appraisal and development of natural resources on that continent.

OBITUARIES

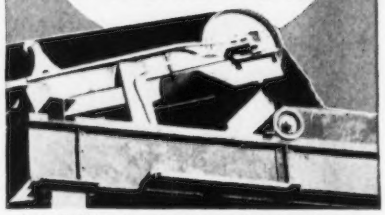
R. Leslie Beattie, vice president and general manager in charge of Canadian operations of the International Nickel Company of Canada, Ltd., died in Toronto on June 10. Joining the company in 1911, Mr. Beattie became vice president and general manager in 1942. He played a large part in International Nickel's wartime expansion program during World War II, assuring vital nickel supplies to the Allies.

(Continued on page 324)

Cedarapids

Built by IOWA

Schrock MOTORIZED HEAD PULLEYS Slash CONVEYOR DOWNTIME 70% to 90%



U.S. PATENT No. 3548399 — OTHERS PENDING

HERE'S WHY!

- No chains, sprockets, sheaves, out in the weather and dirt!
- No chain idlers to keep adjusted or oiled!
- No V-belts to be continually checked, adjusted and replaced!
- No shafts and drives to service and lubricate!
- No motors exposed to damage or weather!

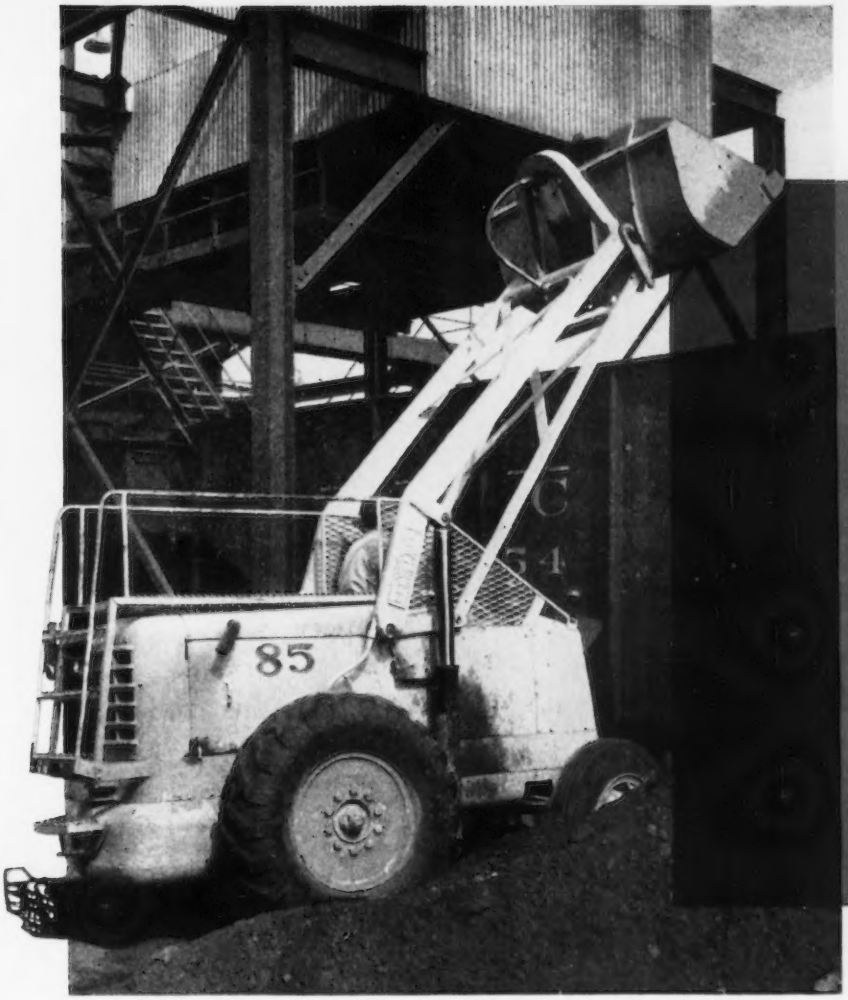
Everything CONTAINED within the pulley!

IT'S *motorized* to eliminate expensive upkeep and cut downtime to the barest minimum on all belt conveyor or belt-bucket elevator operations. *All moving parts are inside the pulley,* enclosed and protected by the pulley shell from weather, dirt and damage. Operation is simple...the pulley shell rotates around the electric motor and reduction gears, which are held stationary by a torque arm attached to conveyor frame. Compact, easy to install, *economical* . . . get complete details from your nearest distributor, or write for Bulletin MP-1 today!

Built for sale in Arizona, California, Nevada, New Mexico, Southern Oregon, Southwestern Utah and Texas by

YUBA MANUFACTURING CO.
(Pulley and Sprocket Department)
Benicia, California

IOWA
MANUFACTURING COMPANY
Cedar Rapids, Iowa, U.S.A.



tipple tender

HUGE tonnages of ore are loaded into cars at this tipple. Cleaning up spillage was a problem before the "PAYLOADER" arrived. Now, equipped with a special tunnelled bucket this agile tractor-shovel straddles each rail and cleans up neatly between and outside of the tracks, piles the ore to one side and then loads it into the cars as they approach the tipple.

This is one of many ways "PAYLOADER" versatility and flexibility is being utilized by the mining industry to lower the cost of producing ore. These unique Hough-built machines are complete integrated tractors-with-shovels, having proper built-in balance and weight distribution, multiple speeds in reverse as well as forward and other outstanding advantages for faster, better, digging, stripping, loading, carrying and dumping. "PAYLOADERS" are available in a wide range of sizes and models up to 1½ cu. yd. bucket capacity — are sold and serviced by a nationwide group or responsible, experienced Distributors. The Frank G. Hough Co., 726 Sunnyside Ave., Libertyville, Illinois.

WRITE for literature on any **PAYLOADER®** tractor-shovel: Model HA — 12 cu. ft.; Model HAH — 15 cu. ft.; Model HE — ⅓ cu. yd.; Model HF — ¾ cu. yd.; Model HY — 1¼ cu. yd.; 4 wheel drive Model HR — 1 cu. yd. and HM— 1½ cu. yd. There is no obligation.

SAY "HUFF"

PAYLOADER®

THE FRANK G. HOUGH CO. • Since 1920

Personals *(Continued)*

Edward C. Badeau, who was in charge of the special publications section of the International Nickel Company, Inc., and editor of Inco Magazine, died of a heart attack on Sunday, May 24. Mr. Badeau, who was 58, had joined International Nickel Company in 1929.

William D. Thornton, president of Inspiration Consolidated Copper Co., and Greeme Cananea Copper Co., died June 9 of a heart ailment. He was 83 years old and was active in business until the day preceding his demise.

APPRECIATION

M. W. Summerhayes, formerly managing director of Wright-Hargreaves Mines, Limited and at the time of his death Consulting Engineer of that Compand, died in Duncan, British Columbia on April 10th last, at the age of 81 years.

He was born in England and was a graduate of the Royal School of Mines. His early years as a mining engineer took him to various parts of South America, Mexico and southwestern United States. He spent the longest period of his professional life in northern Ontario, as operator and consulting engineer in Cobalt and in the Kirkland Lake and Porcupine camps. For several years he was manager of the Porcupine Crown Reserve mine in Timmins in the early life of that company. He was manager of Wright-Hargreaves mine from 1929 to 1949 until he retired from its active management in that year.

Mr. Summerhays was a member of the Canadian Institute of Mining & Metallurgy, the American Institute of Mining & Metallurgical Engineers, the Institute of Mining & Metallurgy and a former president of the Ontario Mining Association. He took a keen interest in sailing, hunting and fishing and in his youth was a noted sprinter.

He was ever a kindly and modest gentleman, with a host of friends who will sympathize with his two daughters, Mrs. Dorothy Barclay and Phyllis Summerhayes of Duncan, B. C., in his passing.

R. L. HEALEY,
General Manager,
Wright-Hargreaves Mines, Ltd.,
Kirkland Lake, Ont.

20 YEAR SUCCESS STORY

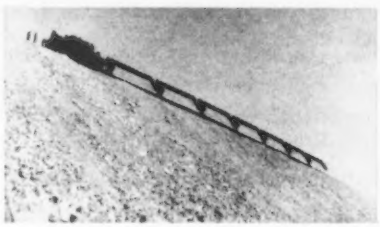
DIFFERENTIAL

Air Dump Cars Serve the World's Richest Copper Mine

At this impressive ore deposit in Chuquicamata, Chile, Differential Air Dump Cars are used exclusively.

From an initial order for 20 cars (shipped in 1929) the Chuquicamata fleet of Differentials has grown to 120 cars. (And 60 additional cars are on order.) All dump cars purchased for this mine since the initial order in 1929 have been Differentials.

Today's Differential Air Dump Car shows some refinements but sticks to the original double-trunnion, double-fulcrum design which has earned a reputation for speedy, trouble-free and satisfactory performance through the years.



Action photographs taken at Chuquicamata

OTHER DIFFERENTIAL PRODUCTS:
Locomotives, Mine Cars, Mine Supply Cars, Rock Larries, Mantrip Cars, Rotary Dumpers Other Dumping Devices and Complete Haulage Systems

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STEEL CAR COMPANY
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New Books

The Manual of Corporate Giving. Edited by Beardsley Ruml and Theodore Geiger. Twenty-four authorities contributed special chapters. Sponsored by National Planning Association, a non-profit organization which aims to improve agriculture, business, labor, and the professions. Your first reaction to the title might be "Why write a book about making business contributions?" Actually, however, this book serves a very vital national purpose because high taxes, inflation, high wages are seriously crippling community services which depend entirely or in part on contributions. Unless these services are to dry up entirely, or fall into the hands of government, business and other organizations will have to keep community services solvent. Because of high taxes, corporations can afford to take advantage of the 5% tax-free allowance on contributions, and at the same time do themselves and their fellowmen a lot of good. This book tells how. Published by National Planning Association, 800 21 St., N.W., Washington 6, D. C. Pp. 415. Price $6.75.

An Outline of Metallurgical Practice. Third Edition. By Carle R. Hayward, Professor Emeritus of Process Metallurgy at M.I.T. An up-to-date text book and reference work on nearly all metals including facts about metallurgical practice from mine to finished product. New chapters have been added to cover recent developments, including titanium and uranium extraction. More than a hundred

(Continued on page 329)

ROLLWAY Bronze-Retainer Roller Bearings

From 30″ O.D. to 3″ O.D.!

Regardless of size—regardless of type, radial or thrust—Rollway Roller Bearings roll right because they're made *right*. Net result of Rollway's precision "right angle design" is longer bearing service—under heavier loads—with lower maintenance cost.

RIGHT ANGLE
Roller ends, precisely square to avoid end-rub, oscillation and side-shock.
RIGHT ANGLE
Bearing surfaces with parallelism that results in unwavering right-line rolling.
RIGHT ANGLE
Separator slots accurately machined to prevent roller skew, slide and uneven wear.

• Our complete engineering and metallurgical services will gladly work with you on your problems. Simply write or wire any sales office. No cost. No obligation. Rollway Bearing Co., Inc., Syracuse 4, N. Y.

Rollway Bearing replacements are available through authorized bearing distributors in principal cities. Consult your classified 'phone directory.

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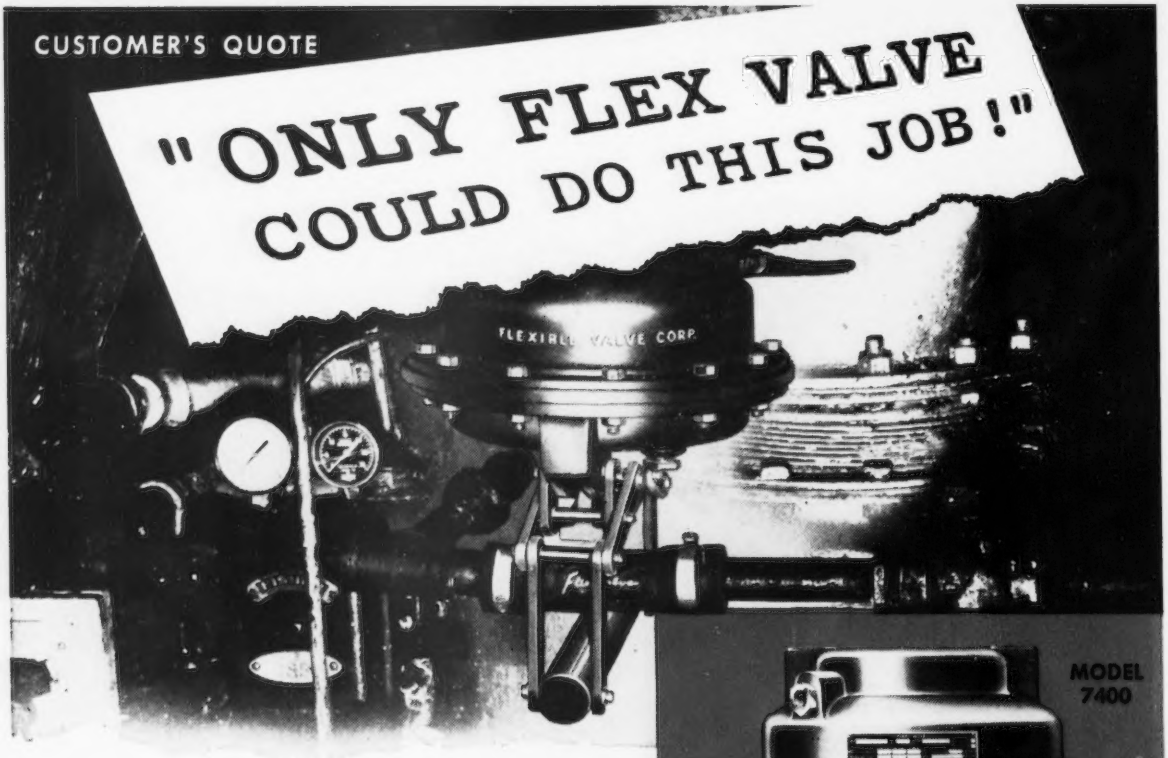
ROLLWAY® BEARINGS

Complete Line of Radial and Thrust Cylindrical Roller Bearings

CUSTOMER'S QUOTE

"ONLY FLEX VALVE COULD DO THIS JOB!"



This diaphragm motor-operated Farris Flex Valve is handling a hard-to-convey, semi-solid slurry in a leading chemical processing plant. Before it was installed, other types of valves clogged after as little as a few hours' service. *Yet Flex Valve has performed perfectly for more than 3 years, in a 24-hour, 7-day-week operation.* Many other Flex Valve installations have been giving trouble-free, continuous service for 15 years or more. If you have a problem in controlling flow of any hard-to-handle fluid, send for Catalog No. FL 382 D

Exclusive FLEX VALVE Features (Pat'd & Pat. Pending)

- Will outwear any metal valve on abrasive service. Proven minimum 11 to 1 life over metal.
- Full pipe capacity.
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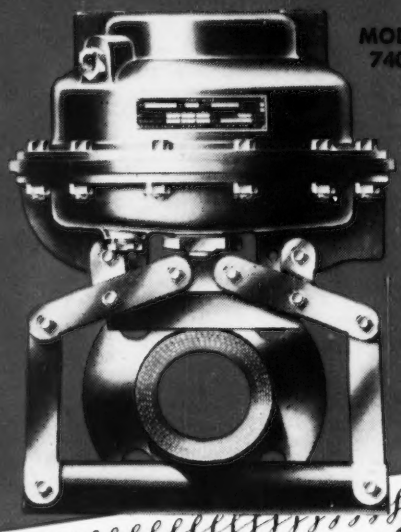

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Books *(Continued)*

new illustrations have been added, and 65 tables have been brought up to date. American Smelting & Refining Co. sponsored the volume. It is published by D. Van Nostrand Co., Inc., 250 4th Ave., New York 3, N.Y.

Nonferrous Physical Metallurgy. By Robert J. Raudebaugh, professor, Georgia Institute of Technology. Approximately two-thirds of this text is devoted to the following metals and their alloys: aluminum, magnesium, copper, and nickel. Topics elaborated in these chapters include metallography, phase systems, radiography, casting, hot working, cold working, finishing, corrosion resistance, and similar proceses. Other nonferrous metals are covered much more briefly. Extensive bibliographies at chapter endings guide the reader to information for more detailed study of the metals. Published by Pitman Publishing Corp., 2 West 45 St., New York, N. Y. Pp. 345. Price $6.50.

Handbook of Applied Hydraulics. Second Edition. Calvin Victor Davis, editor in chief, vice president of Harza Engineering Co., Chicago. Objectives of the first edition are retained in this new second edition—namely to provide a general reference volume on hydraulic engineering which explains fundamental principles and follows up with practical examples. The handbook contains hundreds of illustrations, diagrams, tables, formulas, and problem-solving pointers in addition to much new material on such subjects as gravity dams, spillway sectons and hydroelectric plants with special reference to underground stations. Published by McGraw-Hill Book Co., Inc., 330 West 42 St., New York 36, N. Y. Pp. 1272. Price $15.

Engineering—A Creative Profession. This profusely illustrated 32-page pamphlet, written by a committee of the Engineer's Council for Professional Development and edited by B. G. A. Skrotzki, Chairman of the Guidance Committee, will go a long way toward interesting high-school students in the engineering profession, and is a must in the file of every career guidance councelor. Written in simple language that will appeal to younger people, the pamphlet opens with these topics: What is engineering? Engineering work in all fields has common patterns. The engineer works closely with others who supply him knowledge or help do his job. What an engineer must know. How engineers are educated. How an engineer progresses from college to full responsibility in his work. Separate chapters cover civil, mining and metallurgical, mechanical, electrical, and chemical engineering. Concluding pages tell the career-chooser about engineering col-

(Continued on page 330)

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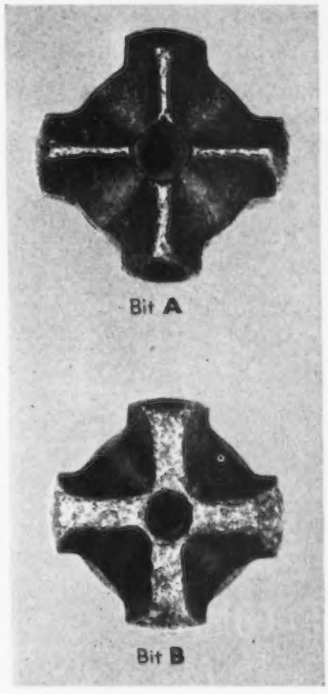

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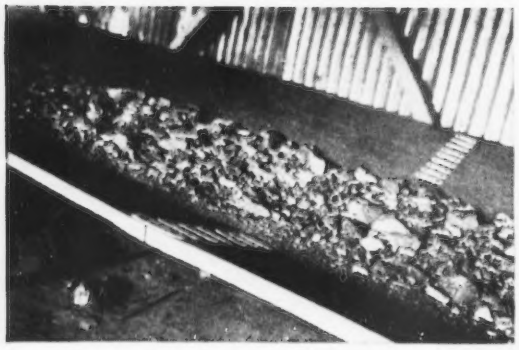

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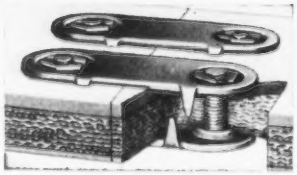

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The Interservice Training Course in Radiological Health. A series of lectures presented at the University of Michigan, School of Public Health, Ann Arbor, Mich. Topics covered in this series of 23 lectures include the following: Radiological Health Course; Public Aspects of Atomic Power Installation; Growth of the Peacetime Uses of Atomic Energy; What is Radiation?; Sources of Radiation; Detection of Radiation; Biological and Medical Effects of Radiation at Low Levels; Radiation Protection from Industrial Hygiene Standpoint; and Public Health Aspects of Civil Defense From Atomic Weapons. Published by the University of Michigan, School of Public Health, Ann Arbor, Mich. Pp. 139. Price $3.

Use of Rare-Earth Metals and Compounds in Stainless Steel Melting. By C. B. Post, chief metallurgist, and H. O. Beaver, metallurgist, The Carpenter Steel Co., Reading, Pennsylvania. A paper presented at the May 27 meeting of the American Iron and Steel Institute in New York.

Mining Operations in 1951. Compiled by M. Reade. Sixty-first annual report of the Ontario Department of Mines. Published by Department of Mines, Toronto. Pp. 122.

Mining Year Book, 1953. Compiled by Walter E. Skinner. Complete and up-to-date particulars are presented for mining companies all over the world. Typical details in company write-ups include: Name of the company, directors, mine offices, main offices, property description, operating results, ore reserves, capital, recent dividends, accounts, and recent share quotations. Published by Walter E. Skinner, 20, Copthall Ave., London E. C. 2. Pp. 856, covering 966 companies. Price 30 s. Post Free (inland and abroad) 31 s. 6d. ($7.00)

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(Continued on page 332)

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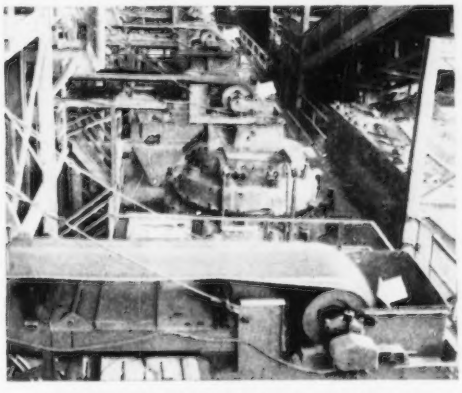

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Industrial Water Resources of Canada. Water Survey Report No. 2, Ottawa Drainage Basin, 1947-48. By J. F. J. Thomas. Published by Canada Department of Mines and Technical Surveys, Mines Branch, Ottawa, Can. Pp. 144. Price 75¢.

Weldability of Metals. A reprint from the Ninth Edition Procedure Handbook of Arc Welding Design and Practice. Published by The Lincoln Electric Co., Cleveland 17, Ohio. Pp. 195. Price 50¢.

Tin in Canada; Occurrences and Uses. By W. R. McClelland, Mineral Resources Division, Canada Department of Mines and Technical Surveys, Mines Branch. Ottawa, Can. Pp. 17. Price 25¢.

Machine Shop Tooling. Data for machine tool operators and machinists. By Charles C. Williams. Published by Wilco Press, 3326 N. Bailey St., Philadelphia 29, Pa.

Mechanics of Materials. By Seibert Fairman and Chester S. Cutshall, Professors of Engineering Mechanics, Purdue University. A basic text on the fundamentals of mechanics of materials featuring numerous examples and problems, and special coverage of combined stresses, and the analysis of formulas governing column design. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Pp. 420. Price $5.75.

Tungsten—Its Metallurgy, Properties and Applications. By Colin J. Smithells, D. Sc., Director of Research, British Aluminum Co., Ltd. A comprehensive book on the metallurgical, chemical and physical properties, and industrial applications of tungsten. Major chapters cover preparation of tungstic oxide, purification and reduction of tungstic oxide, manufacture of ductile tungsten, metallography of tungsten, effect of cold working and annealing tungsten, thermionic properties of tungsten, tungsten-iron alloys, nonferrous alloys of tungsten, tungsten carbides and hard tungsten

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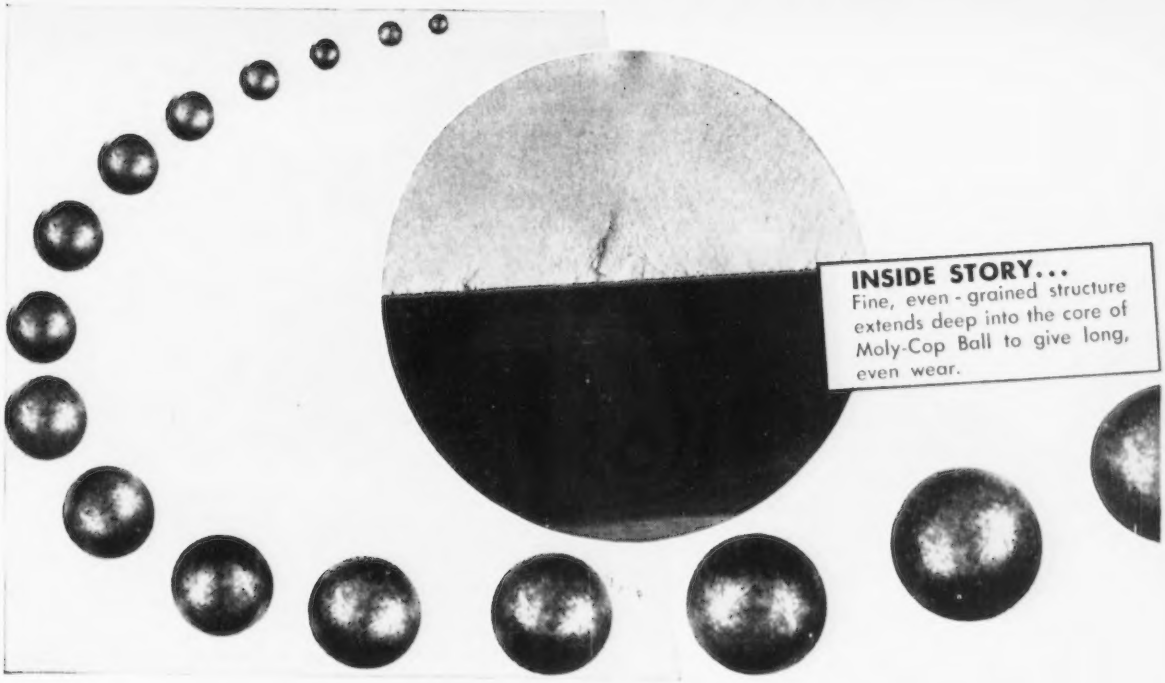

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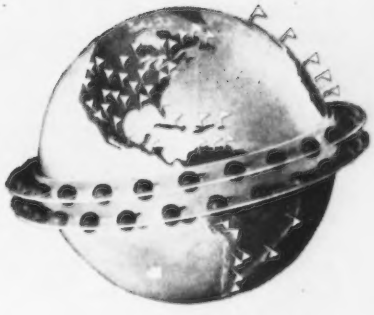

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Plastic medicated water-proof bandages that stick to the skin even when working with oil and gasoline. Extra thin to be worn under work gloves.

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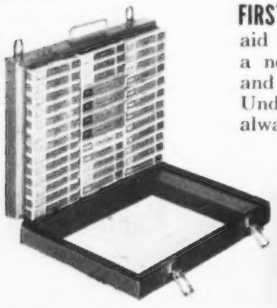

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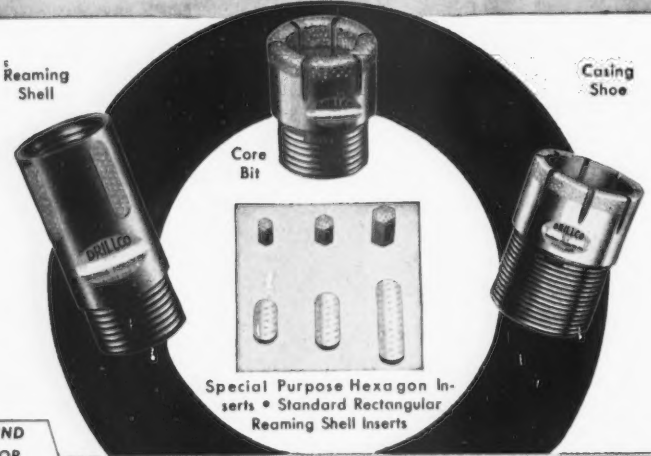

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alloys. Published by the Chemical Publishing Co., Inc., 26 Court St., Brooklyn 2, N. Y. Pp. 326. Price $8.50.

Wood Preservation, Second Edition. By George M. Hunt (Former Director, U. S. Forest Products Laboratory, Madison, Wisconsin), George A. Garrett (Dean, Yale School of Forestry, New Haven, Conn.). Chapter headings of interest in this book include the following: Wood Preservatives; Wood-Preserving Processes; Factors Affecting Penetration and Absorption; Economic Aspects of Preservative Treatment; Properties of Treated Wood; Treating Plants and Equipment. Published by McGraw-Hill Book Co., Inc., 330 West 42 St., New York 36, N. Y. Pp. 417. Price $7.50.

The Determination of Thorium in Ores by the Column Method. By R. J. Guest, Radioactivity Division. Published by the Canada Department of Mines and Technical Surveys Mines Branch, Ottawa, Ontario. Pp. 24. Price 25¢.

The Constitution of Bone China. Part I. High Temperature Phase Equilibrium Studies in the System Tricalcium Phosphate-Alumina-Silica. By P. D. S. St. Pierre, Mineral Dressing and Process Metallurgy Division. Pp. 107. Price 50¢. Published by Canada Department of Mines and Technical Surveys Mines Branch, Ottawa, Ontario.

Annual Report 1952, National Bureau of Standards. You will find this book unusually interesting because it discusses many experimental developments including: Titanium dioxide rectifiers, cobalt-60, glass fiber reinforced plastics, refractory concretes, ceramic coatings for electrical uses, and many others that may result in the substitution of materials in future manufacturing. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. Pp. 89. Price 30¢.

Electrolytic Manganese. By Reginald S. Dean, metallurgical engineer, formerly Chief Metallurgist for U.S. Bureau of Mines. This book really covers the subject thoroughly. Starting with flow sheets of the process (3 illustrated), the author covers chemistry of the process, methods of calcining, leaching, separation, purification and electrolysis in great detail. Other topics are cell structure, flow circuits, new technological developments, composition of electrolytic manganese, manganese plating, and two extensive chapters on ferrous and non-ferrous alloys of electrolytic manganese. Published by the Ronald Press Co., 15 E. 26 St., New York 10, N.Y. Pp. 257. Price $12.

Practical Descriptive Geometry. Hiram E. Grant, Head of Department of Engineering, Washington University,

(Continued on page 339)

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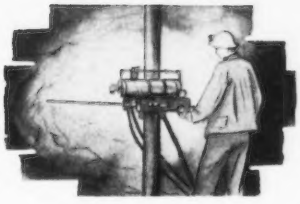

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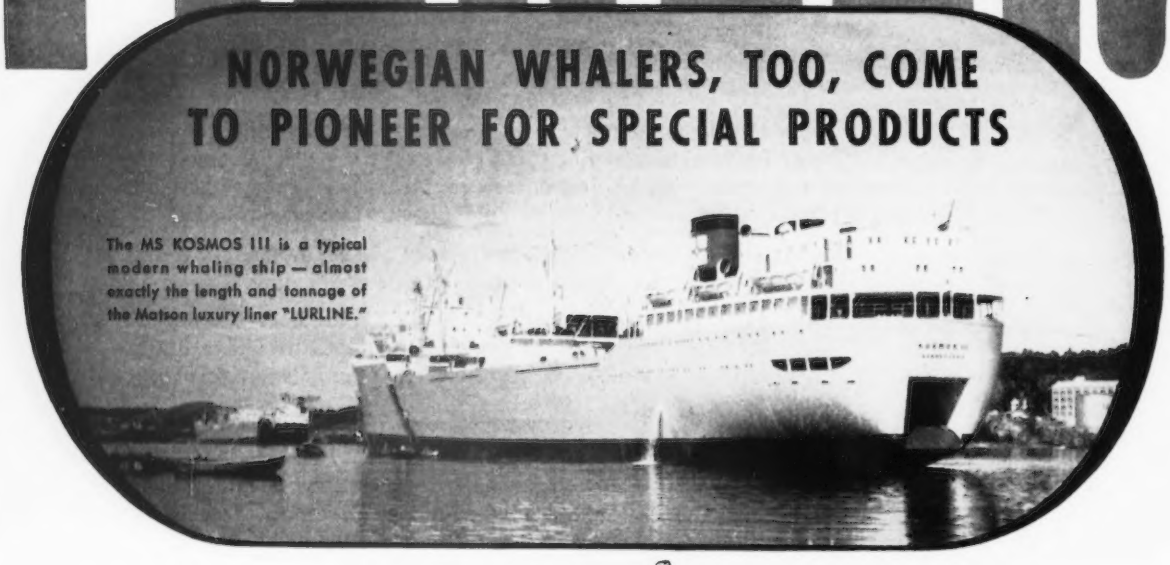
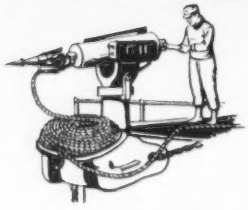


The MS KOSMOS III is a typical modern whaling ship — almost exactly the length and tonnage of the Matson luxury liner "LURLINE."



The efficiency with which the Norwegians hunt down a whale and reduce it to ACTH and a thousand other usable items compares with the best in any industry. Eight to fifteen big, fast whale-hunting ships equipped with harpoon guns kill the whales, blow them up with air to keep them afloat, and then tow them to a mother-ship like the KOSMOS III. This huge ship is a floating whale-oil factory fully equipped with blubber boilers, bone processing apparatus, canning plants, pharmaceutical laboratories, deep freezers, repair shops, and oil storage tanks. She also serves as headquarters for the 8,000 men taking part in each expedition.

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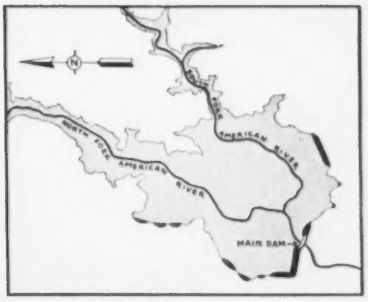
Looking upstream, this view shows in the background the trestle used to place concrete for the main dam. A 162,000-kw power plant is to be located in the left foreground, about 105 ft below the normal surface of the American River.



Sketch shows location of main dam below the junction of the north and south forks of the river, about 20 miles northeast of Sacramento. The saddle dikes which plug low spots between hills around the reservoir bring the length of the dam to 26,730 ft. Shaded portion indicates future reservoir.

Drilling deep blast holes with wagon drills is tricky because the granite is quite hard in some spots and decomposed in others. Large quantities of Bethlehem Hollow Drill Steel are used.

Folsom Dam to supply power and irrigation, tame floods in Sacramento Valley

Usually the American River flows ever so gently down the slopes from the crest of the Sierra range. But if the rainy season happens to strike at a time when melting snow is swelling the mountain streams, the river changes character abruptly, like Dr. Jekyll, and goes on a rampage, roaring through the foothills and pouring floodwaters over the rich farmlands that lie downstream.

Now well under way is a $65 million project, near Folsom, Calif., to tame the American River and at the same time store its valuable water for both irrigation and hydroelectric power.

In addition to the 1,400-ft-long concrete section of the main dam, the Folsom project includes two other dams with wings and eight saddle dikes of rolled earth fill, which bring the overall length to 26,730 ft. The design of the concrete structure calls for not only the building of a dam, but also for a dam site. To anchor the 340-ft-high section, a huge excavation has had to be gouged out of granite far below the normal bed of the river at the spillway area.

Several million cu yd of rock and earth are involved in the $29,444,000 contract which Merritt-Chapman & Scott Corp. and the Savin Construction Corp. hold with the Corps of Engineers, Sacramento District. Large quantities of Bethlehem Hollow Drill Steel, with carbide-tipped bits, are helping to speed the rock excavations.

Before the project is completed in early 1955 some 13 million cu yd of fill and more than 1 million cu yd of concrete will have been placed.

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St. Louis. The author's main purpose has been to bring theory and practice into a very close relationship. The clever use of shaded planes and heavy and dark lines imparts an unusual three-dimensional effect to the drawings of this text. Published by McGraw-Hill Book Co., 330 W. 42 St., New York 36, N.Y. Pp. 253. Price $4.

Compilation of State Tax Law Relating to Oil, Gas, and Mining Properties in New Mexico. By E. P. Ripley. Subjects covered in this bulletin include: Ad Valorem and Production Taxation of Mineral Properties; Severance Tax on Mineral Properties; Sales or Privilege Tax on Productive Mineral Properties; and Compensating Tax. Approximately 40 pages of the report contain reproduced tax forms. Published as Bulletin 32 by the New Mexico Bureau of Mines and Mineral Resources, Socorro, N. M. Pp. 79.

IMM Abstracts: A Survey of World Literature on Economic Geology, Mining, Mineral Dressing, Extraction Metallurgy, and Allied Subjects. Published by the Institution of Mining and Metallurgy, Salisbury House, Finsbury Circus, London. Pp. 200. Price 5 s.

Statistical Summary of the Mineral Industry: Production, Imports and Exports 1945-1951. Colonial Geological Surveys, Minerals Resources Division. Published by Her Majesty's Stationery Office, London. Price £1 7s. 6d.

The Public Domain in 1953. Published by the Bureau of Land Management, Department of the Interior, Washington, D. C. Includes maps, graphs.

Geology of the Mammoth Mine, Shasta County, California. By A. R. Kinkel Jr. and Wayne E. Hall. Published by the Division of Mines, State of California, San Francisco 11, Calif. Pp. 15 plus illustrations. Price 75c.

The Importance of the United States Patent System. Principal addresses on patents given at seminars held by the National Association of Manufacturers, 14 W. 49 St., New York 20. Pp. 72.

The following publications may be obtained from the Bureau of Mines Publications Distribution Section, 4800 Forbes St., Pittsburgh 13, Pa.:

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R. I. 4964. Washability Study of Upper Hartshorne Bed at the Quality Mine, Hackett, Ark. By B. W. Gandrud and H. L. Riley. Pp. 17 plus numerous graphs.

R. I. 4948. Bull Valley Iron-Ore Deposits, Washington County, Utah. By

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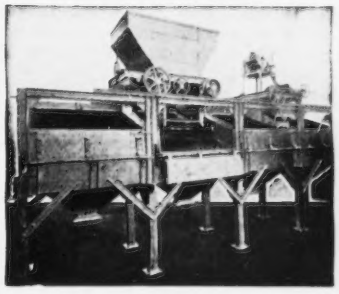

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I. C. 7658. National First-Aid and Mine Rescue Contest, Columbus Ohio, Oct. 2, 3 and 4, 1951. By W. H. Tomlinson. Pp. 71 plus illustrations.

R. I. 4967. Use of Torque Wrench to Determine Load in Roof Bolts. Part I. Slotted-Type Bolts. By A. J. Barry, L. A. Panek, and J. A. McCormick, Pp. 7 plus illustrations.

I.C. 7650. State Compensatory Provisions for Occupational Diseases. By G. G. Morgis and S. J. Davenport. (Very important for safety engineers.) Pp. 125.

The following bulletins may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Note prices at end of each item:

Geophysical Abstracts 151, October-December 1952. Published by the Geological Survey as Bulletin 991-D. Pp. 95. Price 25¢.

Beryllium Deposits of the Mount Antero Region, Chaffe County, Colorado. Geological Survey Bulletin 982-D. By John W. Adams. Pp. 25. Price 15¢.

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The following bulletins may be obtained from the Department of Geology and Mineral Industries, State of Oregon, 1400 S. W. 5th Ave., Portland 1, Oregon. Prices as noted:

Geology of the Albany Quadrangle, Oregon. By Ira S. Allison, Oregon State College. Bulletin No. 37. Pp. 18 plus map. Price 75¢.

Bibliography of the Geology and Mineral Resources of Oregon (2nd Supplement). Compiled by Margaret L. Steere, Geologist. Bulletin No. 44. Pp. 61. Price $1.

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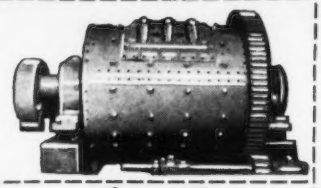

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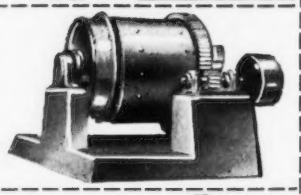

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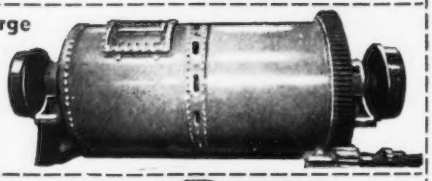

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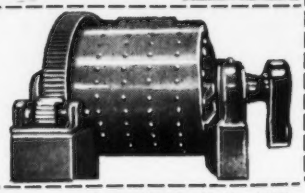

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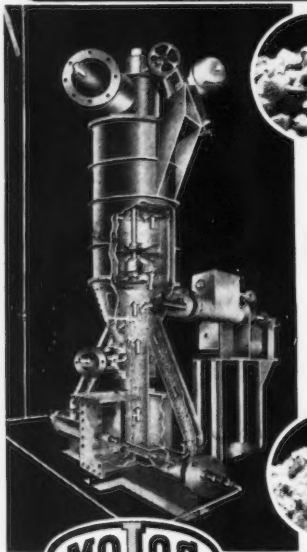

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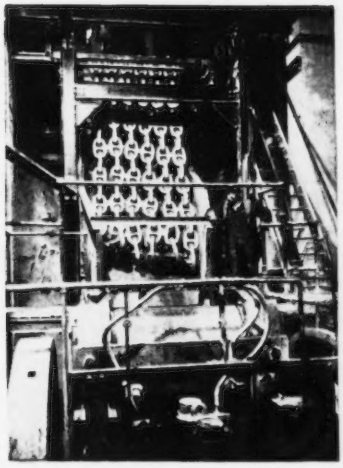

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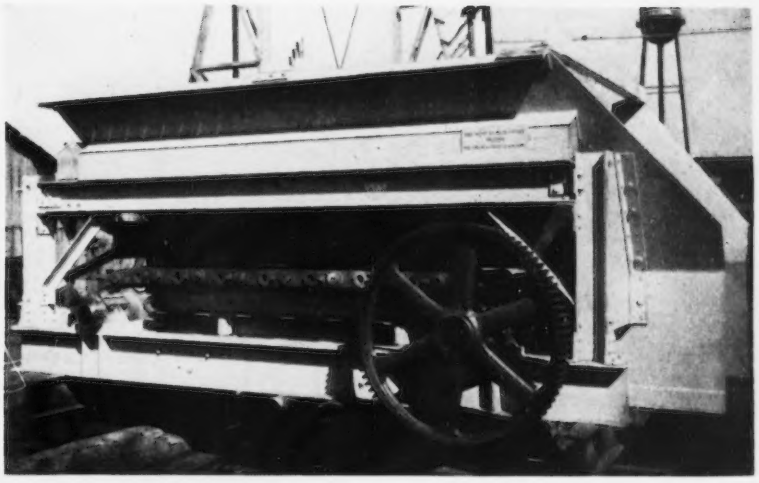

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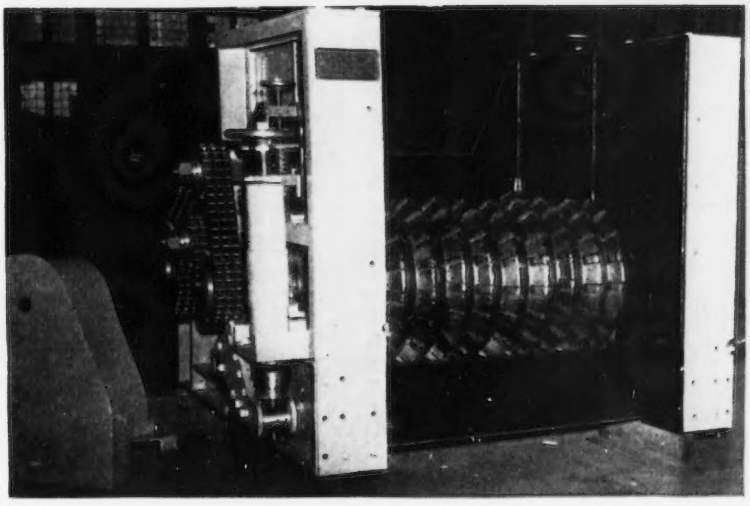

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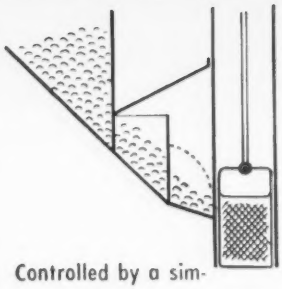

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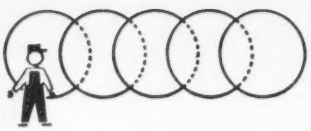

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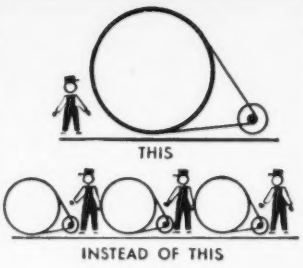

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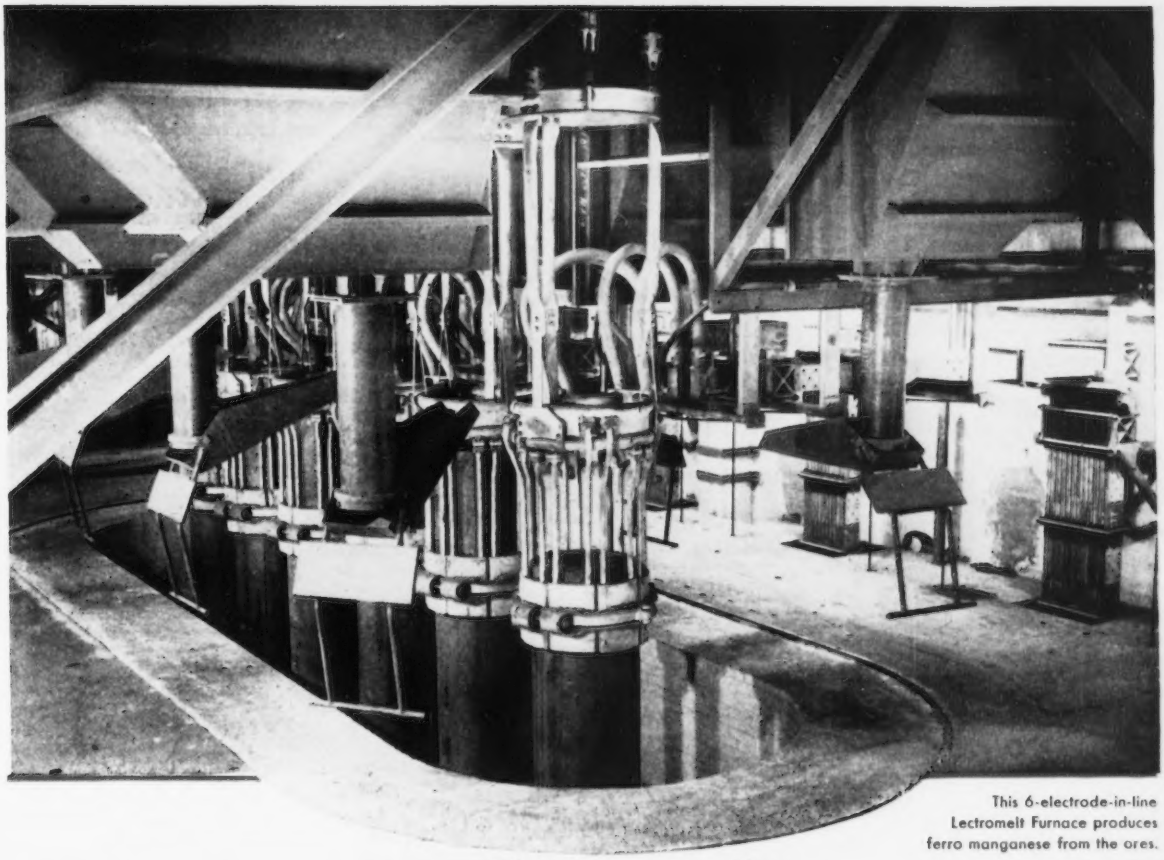

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1. Electrodes equidistant from refractories at 14 places, instead of three places as in a circular furnace . . . avoid super-heated zones, make heat distribution uniform.

2. Three-phase power arrangement allows each pair of electrodes to operate at independent voltage settings, giving greater flexibility; permitting temperature increases, for example, of a viscous slag near the taphole before making a tap.

3. You can space electrodes for best operation by sliding electrode gear longitudinally . . . without shutting down furnace.

4. Furnace charge protects sidewalls, adds life to carbon or refractories.

5. Furnace is oblong; requires less space . . . it's mechanically easier to charge.

6. In-line electrodes permit simple monorail crane for adding sections easier in less time.

Write for Bulletin No. 105 giving data on smelting and refining furnaces.

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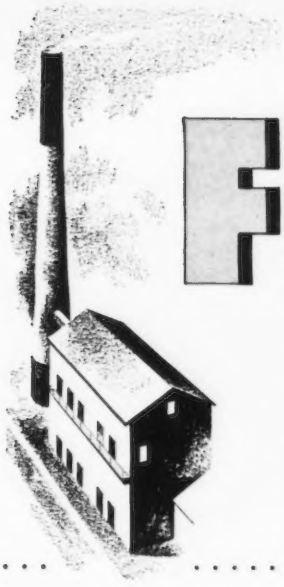

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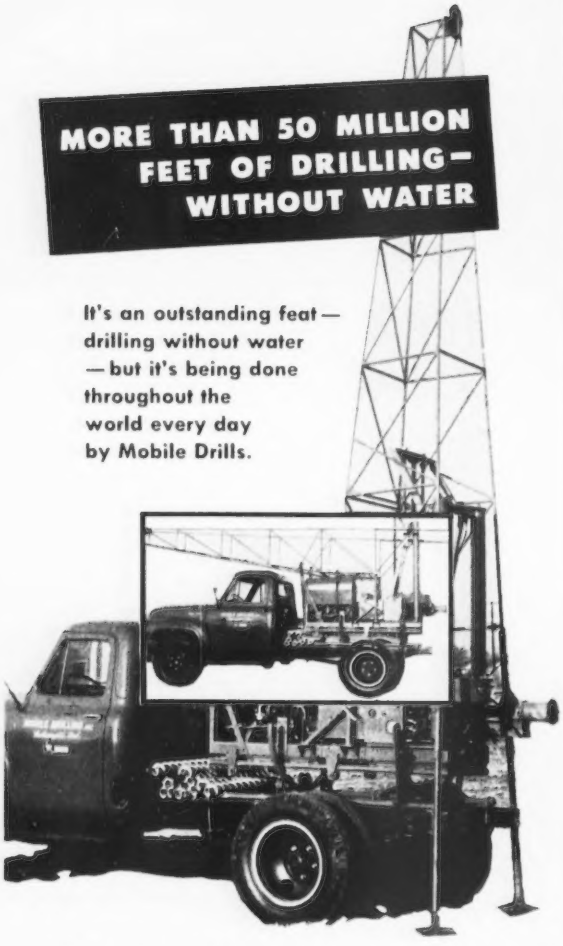

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POWDER BOX PRICES ARE AS FOLLOWS:

No. 9	$2.55 ea.	No. 25	$5.10 ea.
No. 12	2.95 ea.	No. 36	6.50 ea.
No. 16	3.45 ea.	No. 50	7.60 ea.
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For Tamping Explosive Shots: Poles are round, made of Hardwood. Sizes to 10' long. Price per lineal ft.: 1" dia. 8c; 1⅛" dia. 12c; 1¼" dia. 14c; 1⅜" dia. 16c; 1½" dia. 18c; 1¾" dia. 28c; 2" dia. 32c. Special diameters and lengths can be furnished. These Poles meet the requirements of the New Federal Mine Safety Code.

SECTIONAL TAMPING POLES

These poles are made of straight grained wood and are coupled together with removable wood pins held in place in recessed grooves by a rubber band and can be quickly connected and unconnected.
Couplers and Head Blocks are 4, 5 and 6 inches in diameter. Please specify size when ordering. Poles are 1½" in diameter.
Head Blocks, $3.70 ea.; Couplers, $3.90 ea.; Poles 12 feet long, $3.60 ea.; Poles 14 feet long, $4.20 ea.; Poles 16 feet long, $4.80 ea.; Poles 18 feet long, $6.30 ea.; Poles 20 feet long, $7.00 ea.; Poles 22 feet long, $8.80 ea.; Poles 24 feet long, $9.60 ea.

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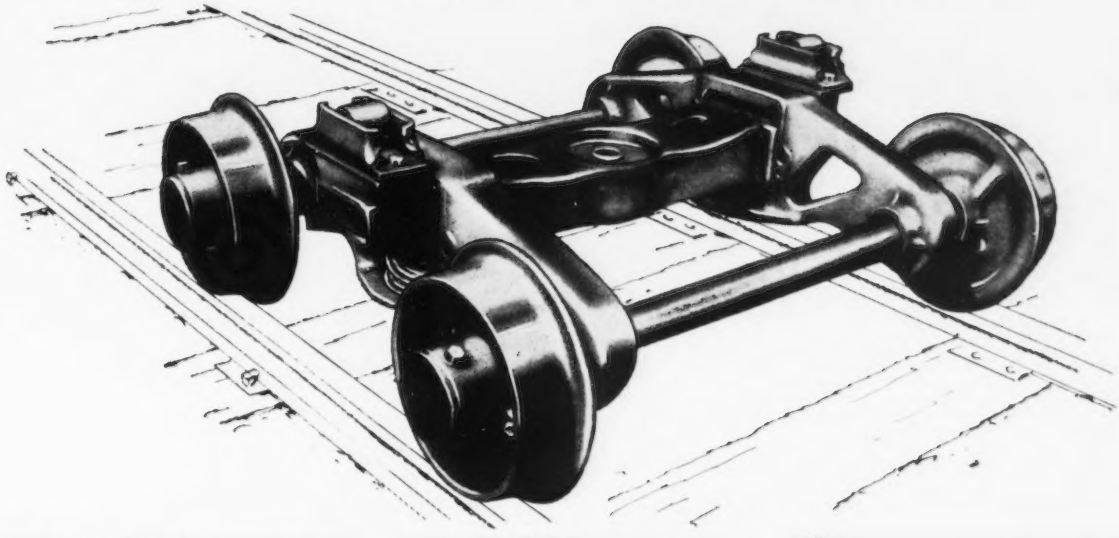
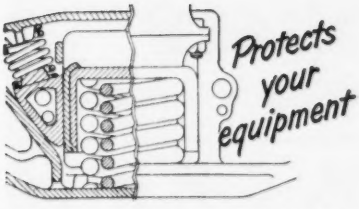
We also manufacture Shot Firing Units, Wooden Mallet and Wedge Sets, Trolley Poles, Sounding Sticks, Mine Rollers, Insulation Blocks and Brake Blocks

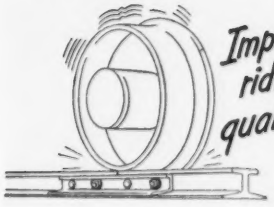
Specify NATIONAL NC-1 trucks for your large 8-wheel mine cars





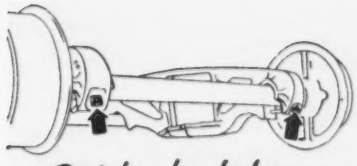
Protects your equipment

Shock-absorbing system of the NC-1 truck is similar to designs of the American Association of Railroads for full-size freight car trucks. The oscillation control mechanism (see cutaway) floats your loads over the tracks.



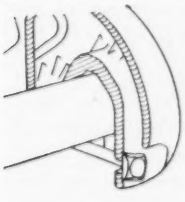
Improves riding quality

Track irregularities are no hindrance to higher speeds for mine cars when they are equipped with National NC-1 trucks. Truck design and large diameter, low stressed, load-carrying springs improve riding qualities.



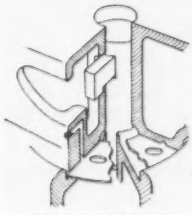
Quick wheel change

Removal of bolt at each end of side frame permits quick wheel and axle assembly change. Cuts repair time and costs . . . keeps cars in operation longer. No lengthy tie-ups for wheel and axle changes on a National NC-1 truck.



Keeps itself in alignment

The NC-1 truck stays square automatically. V-shaped slots over the axles make it impossible for the truck to get out of square without lifting entire weight of the car body and lading—means longer service, less repairs.



Large center bearing

National NC-1 truck's large center bearing provides maximum wear life by reducing per-square-inch loading . . . provides bolster stability. Has easily replaceable centerplate shims and adequate provision for lubrication.

Integral design

Side frame and bolster are each of one-piece, integrally cast construction similar to the National C-1 trucks used on railroads. Gives maximum strength, minimum weight — has *no welds or rivets to shake loose.*

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For minimum maintenance time and spillage, plus maximum equipment protection—specify National NC-1 trucks on your next 8-wheel mine car order.

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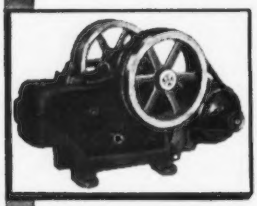

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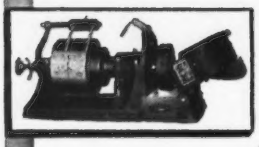

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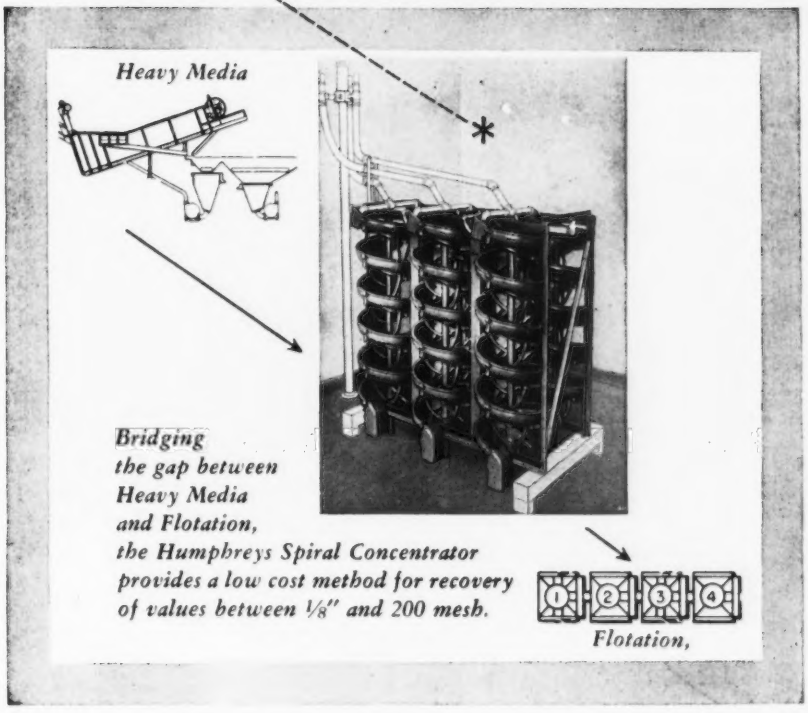


★ *for* **separation of minerals of different specific gravity in ores at sizes generally minus 10 mesh.**

★ *for* **recovery of liberated values too coarse for flotation.**

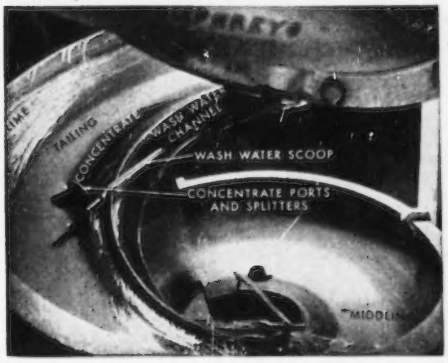
★ *for* **recovery of other ore values from flotation tailing.**

★ *for* **recovery of values too fine to be economically treated by heavy-media separation.**

★ *for* **cleaning minus ¼ inch bituminous or anthracite coal.**

Low cost of installation
Low operating costs
No moving parts

Concentrating action of Humphreys Spiral—Note wide black band of concentrate entering upper outlet, which is set for a wide cut, also narrow black band of middling entering lower outlet set for thin cut. In cleaning fine coal, phosphate rock and mica, refuse and middling are discharged from the concentrate ports and cleaned product follows the path shown as tailing.



The installation, operation and maintenance costs of Humphreys Spirals are so low that economical concentration of materials, which could not heretofore be worked at a profit, is now possible. There are no moving parts, no vibration, weight per unit of capacity is low and requires only a light foundation. Floor space per ton treated is very small.

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A testing laboratory is maintained in Denver by the Engineering Division of The Humphreys Investment Company. Results obtainable in a full size plant may be determined by tests of a representative sample of minerals or coal weighing 300-500 pounds.

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FOR SPOTTING CARS FOR LOADING

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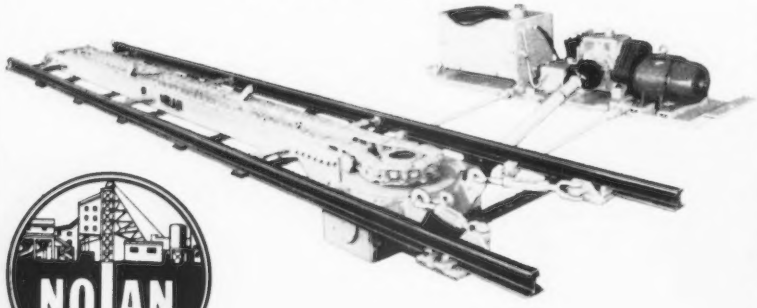
Shown in Illustration Below

2. HYDRAULIC FLUID MOTOR DRIVE
Hose Coupled to Remote Power Unit

3. HYDRAULIC CYLINDER TYPE
Hose Coupled to Remote Power Unit



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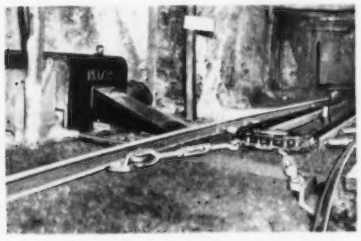

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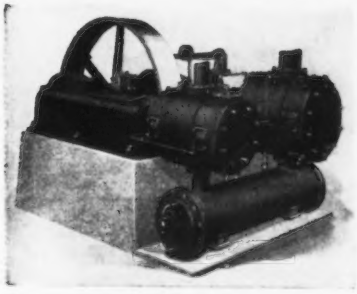

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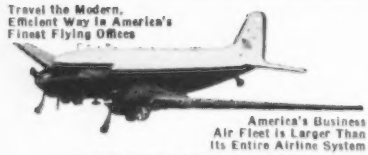

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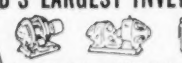

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16"	4	1/8"	1/32"	28 Oz.
18"	4	1/8"	1/32"	28 Oz.
20"	4	1/8"	1/32"	28 Oz.
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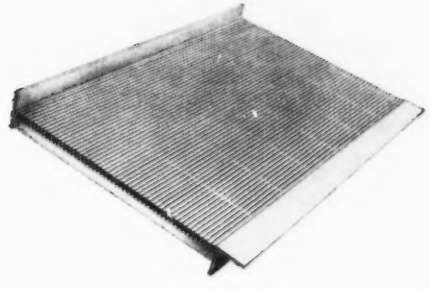

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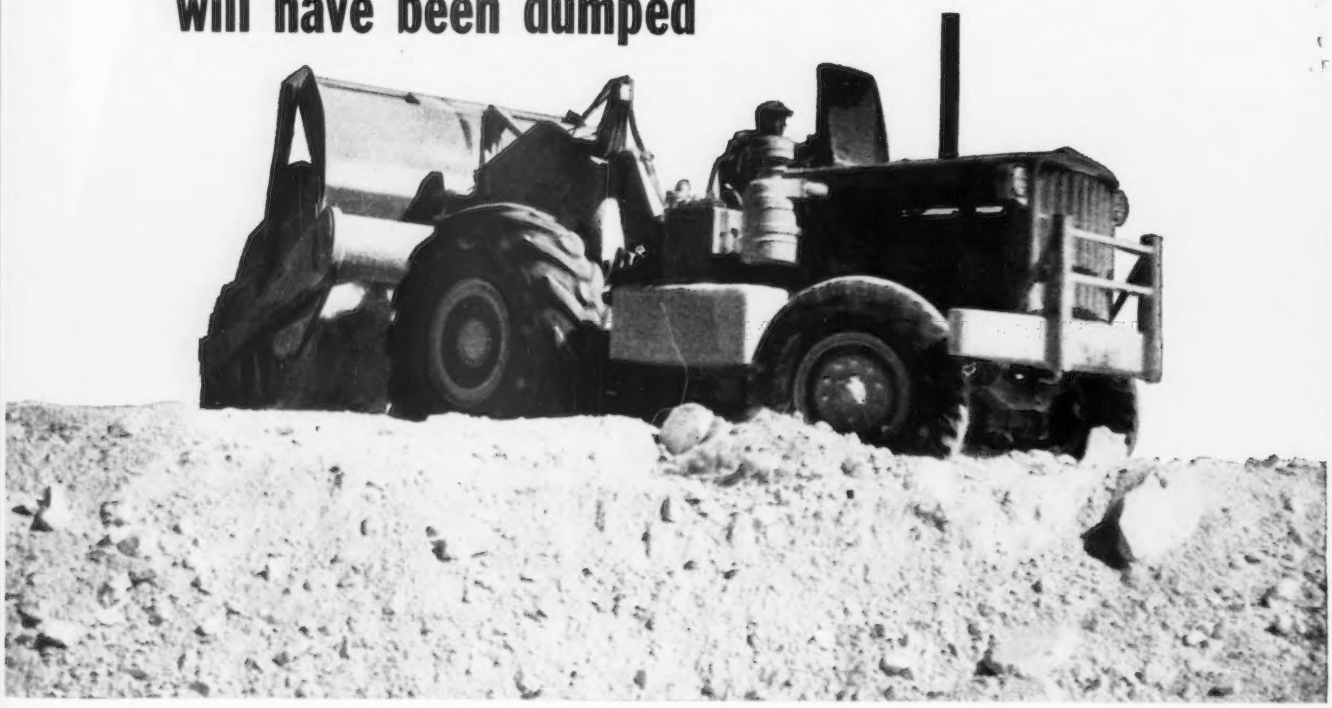

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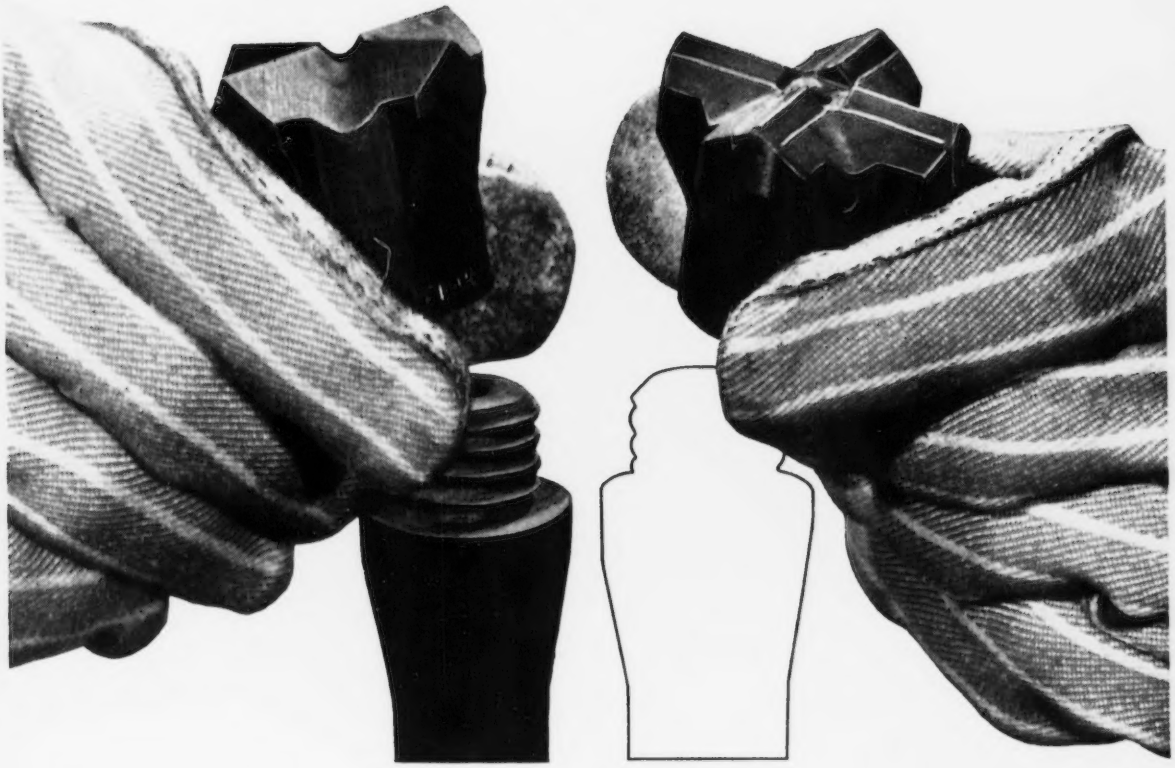

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